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Plate 1. Eskimo hunters



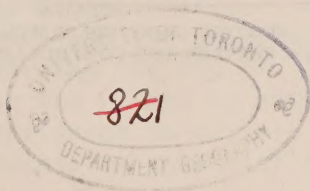
Canada

Department of Mines and Technical Surveys

GEOGRAPHICAL BRANCH

An Introduction to the Geography of

# THE CANADIAN ARCTIC

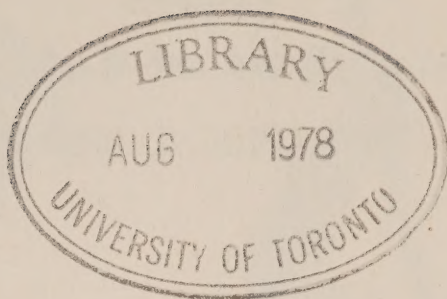


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## PREFACE

This publication is the second in the series of Information Handbooks on Canadian regions, published in the program of Canadian geographical research under the supervision of N.L. Nicholson.

The main part of the text was written by J.L. Robinson, of the University of British Columbia, when temporarily on the staff of the Geographical Branch. Other members of the Branch, particularly N.L. Nicholson, J.K. Fraser, and B.V. Gutsell, contributed substantially to the sections on government, soils, settlement, and exploration, and D. Leechman, of the National Museum of Canada, contributed to the chapter on the Canadian Eskimo. The final maps were prepared by R.T. Gajda.

Although various aspects of the arctic geography of Canada have been presented before, this handbook attempts to bring all the facts together. It is thus designed to present a broad outline of the physical environment of the Canadian Arctic, man's adaptation to this environment, and the utilization of its resources. It describes the way of life of the native Eskimo, and traces the routes by which the white man has penetrated northwards to explore and survey, to develop, and to administer this vast area.

The Director of the Geographical Branch wishes to thank the members of other branches of Government for their courtesy in reading and commenting on different chapters. In particular, acknowledgments are made to G.E.B. Sinclair, Director, Northern Administration and Lands Branch, and H.F. Lewis, Chief, Wildlife Division, both of the Department of Resources and Development, and to W.A. Bell, Director, Geological Survey of Canada.

J. Wreford Watson,  
Director, Geographical Branch,  
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Figure 1. Strategic location map of the Canadian Arctic.

## INTRODUCTION

By J. Wreford Watson

The increasing interest in the Arctic regions evinced by government, business, and scientists in the last decade seems to warrant a general geographical survey of the region.

Although the Arctic has long been a region of exploration, it was neglected as an area of potential exploitation. Its remoteness, the inclemency of the climate, and the small population have been sufficient to keep it at the margin of affairs. However, recent economic trends and world events have given it a new significance, in which Canada is sharing.

## LIMITS OF THE ARCTIC REGION

Ideas of what constitute the limits of the Arctic region have changed with the advance of science. The term "arctic" means a different thing today from what it did when it was first used. Originally it was an astronomical term describing the relationship between the Great Bear (Greek, arktos - a bear) and the earth. Later the word "arctic" was used of the area in which there is one day or more when the sun does not set. The circle of latitude ( $66^{\circ} 32' \text{ N.}$ ) that encloses this region was called the Arctic Circle.

Early scientists thought that the Arctic Circle had some kind of climatic significance separating the frigid zone of the northern hemisphere from the temperate zone, and so the word "arctic" was applied to regions around the North Pole with a characteristically frigid climate. But as the science of climatology advanced it became apparent that the climatic zones of the earth did not coincide with latitudinal circles. Not all areas within the Arctic Circle were found to have a frigid climate or to induce an arctic mode of life. On the other hand, the frontiers of the Arctic climate were seen to extend, in places, well south of the Circle.

Consequently, the term "arctic" used in the climatic sense covers a much wider area than that enclosed by the Arctic Circle. As it is the climate that counts in determining the adaptation of plant and animal life and of human occupation to the North, rather than any mathematical line, the climatic meaning of the word "arctic" is now generally accepted to define the Arctic region. The best indicator of climate is vegetation, and the best indicator of the Arctic climate is the tree line. Thus, the Arctic can be said to begin north of that meandering line where the forest ends.

#### THE SIGNIFICANCE OF THE ARCTIC AS A WHOLE

Of recent years there has been a widespread search for new supplies of all kinds of fuels, minerals, and other products. The exhaustion of many resources in the older developed regions, especially in Europe, together with the growing rate of depletion of resources in newer lands, have quickened this search. Although it is most active in the more accessible and populous lands, it is also concerned with the potentialities of the Arctic regions.

To aid the search for information on the Arctic region and to assist in the development of this region, new methods of transportation and new transportation routes are being tried. In Europe and Asia the extension of sea routes into the Arctic has furthered the exploitation of the whole region. Yet air routes in the North are proving of even greater importance, and it is significant that the shortest distances between mainland masses of the northern hemisphere are not laterally across the Atlantic or the Pacific, but follow the Great Circles over the Arctic region.

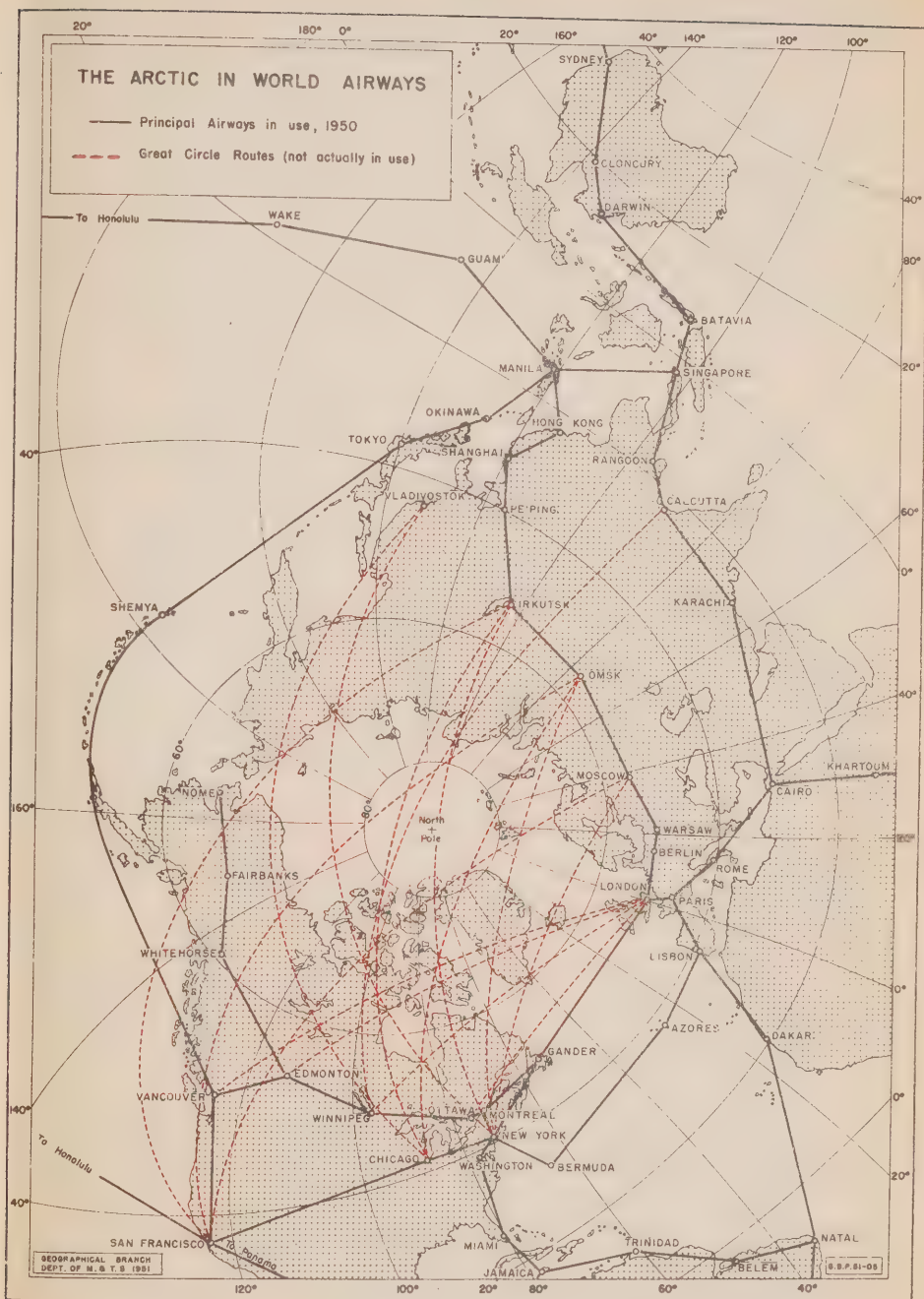


Figure 2. The Arctic in World Airways.

World population is growing at a very high rate. The most accessible and agreeable areas of the world have been occupied. The largest undeveloped regions left are the tropical deserts and jungles and the arctic areas of the earth. Those countries with tropical desert districts have made considerable strides in tapping oil and mineral wealth, and in advancing cultivation through irrigation. The countries with districts in the Polar regions are seeing a steady, if slower, penetration of the northern or southern extremities of the continents. This slow push outwards from the overpopulated zones in the middle latitudes is discovering new possibilities in these regions and is developing settlement there.

### THE CANADIAN SITUATION

Canada shares all of the possibilities and trends of development that have been described for the Arctic as a whole. However, it has had such considerable developments to undertake in its southern regions that it has not had to look to the North in the same way as countries in Europe and Asia. Nevertheless, the geographical position of Canada gives the country a significance in northern affairs that is having increasing effect upon the use of the Arctic. Canada has access to the shortest crossings between Continental North America and the great nations, teeming populations, and markets of Europe and eastern Asia. These crossings are in the northern part of the North Atlantic and North Pacific Oceans and across the Arctic Ocean. Several nations in North America, Europe, and Asia are today interested in the North and some of them have Arctic possessions.

Development in Canada's Arctic region is at present limited. Some commercial fishing and fur trapping are carried on. Little mining is attempted, comparable to the cryolite mining in Greenland or the mining of coal in Spitsbergen. No significant routes traverse the area, with the exception of the Churchill-Hudson Strait passage, and Montreal-Goose Bay-Transatlantic flight. The economic problem is to maintain the existing Eskimo, Indian, and other settlements and improve the condition of their peoples. Nevertheless, the extension of police patrols, weather services, and of Arctic defences have brought with them additional problems of adapting modern requirements in food, shelter, and transportation to prevailing conditions.

The administration, protection, and development of these northern settlements and the rendering of these services have been materially assisted by the growth of northern airways. Canada has pioneered in air transport in the north lands. The fact that most of the potential Great Circle routes between this continent and Europe and Asia extend over the Canadian Arctic, and that these would be shorter connections than those now being used over the North Atlantic or North Pacific is significant. For example, if one were to fly along a Great Circle from Montreal over the Canadian Arctic to New Delhi in India, he would save approximately 1,500 miles compared with the present distance covered by the flight by London, Cairo, and Karachi.

Though few international routes now cross Arctic Canada proper most Canadian flights are affected by the weather of the Arctic. The weather of the whole of Canada and of its flanking seas is dominated by Polar air masses. Thus, not only flying activities, but all activities, agricultural, industrial, commercial, and even social, are influenced throughout Canada by what is happening in the Canadian Arctic. Even that part of Canada that lies beyond the Rockies may feel the impact of arctic air from time to time. Throughout the Prairies, central Canada, and the Atlantic provinces this impact is very considerable. One of the great needs to know more about the Arctic is to understand its weather and to know how that weather affects the rest of the country.

The existing organization of settlement and administration is the basis for whatever future developments there may be. Canadians have experienced an attractive force in the opportunities for mineral development, and this has drawn groups to the verge of the Arctic. It is unlikely that the movement of people north to the Canadian Arctic region will be large, or that it will be based on any extensive commercial exploitation of the land. Yet the promising developments in the subarctic of mining, lumbering, and pioneer agriculture in small districts indicate that there is a trend to the North. This trend is even more evident in Alaska, and is also present in the settlement of Greenland.

Whether or not the economic use of possible reserves of metals and of fuels in the Arctic region is now feasible, knowledge of their distribution and extent would be useful as a basis for its further development.

The main tasks in considering the Canadian Arctic seem to be to sustain its present native populations and increase their standards of living; to use the existing administrative and social services as a foundation on which any future expansion of settlement may build; to acquire knowledge of the resources that are available; to continue to find better methods of adaptation to Arctic conditions and to see more clearly the significance of the Arctic for the rest of Canada and for the world.

## DIVISIONS AND GENERAL CHARACTERISTICS OF THE CANADIAN ARCTIC

The Canadian Arctic, being that part of Canada north of the tree line, takes in the northeastern part of the District of Mackenzie, all but the extreme southwestern part of Keewatin District, and the whole of Franklin District in the Northwest Territories. It also includes a strip of coast in Yukon; a large part of the Ungava district of the province of Quebec; and smaller areas in the north of the provinces of Newfoundland (Labrador), Ontario, and Manitoba.

Thus four Canadian provinces and both the northern territories possess arctic terrain. Even Ontario just reaches into the Arctic region. Altogether, the Arctic region in Canada covers about 1,000,000 square miles, which is between a quarter and a third of the total area of Canada.

Yet it contains only about 10,000 people, or less than one-tenth of 1 per cent of the Canadian population.

Although we speak of the Arctic region as though it were one region, this is only to distinguish it from other parts of Canada, from which it differs in general characteristics. But when the region is examined more closely it is seen to have many differences of its own.

The Western Arctic consists in general of low, rolling relief formed on horizontally bedded sedimentary rocks with only a small sector of the older crystalline rocks in the east. In the main it is reached from Mackenzie Valley. It includes the somewhat barren coast of Yukon and the northeastern part of the District of Mackenzie, together with the northwestern part of Keewatin District and the islands in the southwest of the Canadian archipelago.

The Eastern Arctic by contrast consists principally of rugged upland made of crystalline granites and gneisses. It is reached mainly from Hudson Bay or the Atlantic Ocean. It includes: eastern Keewatin; the treeless parts of northern Manitoba and Ontario; northern Quebec; a strip of Labrador; and the southeastern Arctic islands.

The Northern Arctic lies north of a remarkable east-west strait of water that divides the nearer Arctic islands, grouped with the peninsula and coasts of the western or eastern mainland, from the farther Arctic islands. This strait is known by different names in its several parts, McClure, Melville, Barrow, and Lancaster. It separates the High Arctic from the rest of Arctic Canada. North of it lies a desolate stretch of islands and sounds with few if any permanent settlements, where only small areas become ice-free during the summer.

By examining the major subregions in some detail, and by surveying the Arctic region as a whole, it is possible to appreciate what the limitations and problems of the area are, and what adaptations modern administration, settlement, and development have made or can make to the environment.



## CHAPTER I

### PHYSICAL GEOGRAPHY: LAND

#### THE ROCKS

The foundations of the Canadian Arctic consist chiefly of two kinds of rock. Much of the Eastern Arctic is underlain by Precambrian rocks of the Canadian Shield, which comprises the geologic base of two-thirds of Canada. Sedimentary rocks ranging in age from Palaeozoic to Tertiary rest on these ancient rocks, form a belt through the central Arctic islands, and include most of the far northern and western Arctic islands. Topographic features are largely controlled by the geologic structure and composition of the underlying rocks, and, in general, the areas of Precambrian rocks, chiefly granites and gneisses, are rugged or rounded whereas the sedimentary rocks more typically result in topography that is level or low in relief. Glacial drift of varying depth covers much of the region and often modifies the influence of the bedrock on the topography.

The geology of the Arctic is based mostly on scattered reports from coastal areas; the inland areas, except for a few traverses, can only be interpreted from topographic evidence in aerial photographs. The detailed geology, particularly the identification of the sedimentary rocks, is as yet little known.

The exposed rocks of the Arctic islands are oldest in the southeast, and become progressively younger to

the northwest. These younger strata overlies the old Precambrian rocks in remnants along the northwest border, but have an almost-continuous succession to the north and northwest. In the Northern Arctic, the youngest known rocks covering any large area are Triassic in age, but there are also small areas of younger rocks of Tertiary age. The sedimentary rocks have a thickness of over 10,000 feet in parts of Ellesmere Island and are generally flat-lying, but in the northern part of the island they have been extensively folded into mountain ranges. In the Ringnes Islands and northern Bathurst and Melville Islands the sedimentary rocks have been folded into dome-like structures.

In the Western Arctic the Precambrian rocks of the mainland outcrop in small areas along the south coast of Victoria Island and in an extensive belt from Minto Inlet to western Hadley Bay in the northeastern part of the island. Banks Island, in the western part of the region, is built partly of younger rocks, probably of Cenozoic age.

Much, or possibly all, of the Arctic was glaciated during the last Ice Age, which covered most of Canada with a continental ice-cap several thousands of feet thick. This ice-sheet had some of its centres and perhaps its main source of origin in the Eastern Arctic. Areas of permanent ice-caps, glaciers, or snowfields still cover several large sections in the higher areas of Ellesmere, Axel Heiberg, Devon, and Bylot Islands, and in scattered areas along northeastern Baffin Island. When the weight of the ice load decreased at the end of the Ice Age, the land slowly began to rise. Ancient marine beach lines and terraces, now found over 500 feet above the present water level along the coasts of many of the Arctic islands, and as high as 800 feet in western Keewatin District, record this uplift. In areas of rough topography, these terraces have proved useful locations for settlements and air bases. The present surface of subdued glacial drift topography, which is typical of much of the Arctic mainland and the lower areas of the Arctic islands, was exposed after the ice melted. Where bedrock is exposed, especially softer sedimentary types, post-glacial frost action has disintegrated the rock, mantling the surface with loose, frost-riven, rocky debris.





## TOPOGRAPHY

### The Western Arctic

#### Western Arctic Mainland

Topography in the Western Arctic is characterized by combinations of low, level, tundra plains and rounded barren hills. There are no mountainous regions, and the rough hilly country seldom exceeds 1,500 feet. The mainland coast from Yukon Territory to Boothia Peninsula is frequently low, but in places hills rise abruptly a few hundred feet above the water. Shallow water is found offshore along the low-lying coasts, and deeper water exists off the steeper coasts.

Yukon Coast to Pearce Point. Along the Yukon Territory coast, a low tundra strip about 10 miles wide fronts the rugged Richardson and British Ranges. Numerous small streams cross the rolling plain, and lakes dot its surface. The Mackenzie River delta and the coast eastward to Baillie Island are very low and swampy. Innumerable lagoon lakes, cut off from the seaby strips of beaches, cover the coastal regions, and farther inland there are many linear lakes. The eastern side of the outer delta of the Mackenzie is characterized by many small conical hills, called "pingoes", which are particularly numerous in the Tuktoyaktuk area. The inland country to the eastward is gently rolling tundra, with numerous lakes filling the depressions above the permanently frozen ground.

The coast east of Baillie Island is marked by steep bluffs rising about 200 feet above the water; this high ground continues southeastwards with Smoking Mountains rising above the west side of Franklin Bay to some 500 feet altitude. Inland, Horton River is deeply entrenched into the glacial-covered upland surface. South of Barnley Bay, the low coast is backed by hills marking the eroded front of the interior plateau. Rivers are incised between steep banks near the coast, but inland they meander along ill-defined valleys. The lake-dotted tundra around Horton and Anderson Rivers has a rolling topography and ample tundra vegetation, and there are no major topographic features rising above the general level of the low plateau.

Pearce Point to Coppermine. Between Pearce Point and Stapyilton Bay the coast is un-indented and trends to the southeast. In several places there are low, cliffed headlands, 50 to 200 feet high, forming the eastern ends

of a series of ridges with north-facing escarpments. These ridges extend inland in series, with gentle south-facing slopes. Where the coast is low, the surface rises gradually in steps to an interior rolling plateau. Isolated hills occasionally rise above the drift-covered surface. Tundra vegetation of grasses, sedges, and mosses is fairly abundant over the interior, and supports herds of caribou in the summer. Inland from Bernard Harbour, the coast rises in a series of ancient beaches to a rolling grassy interior. North and south of Rae River, south-facing escarpments have been eroded into mesa-like forms by tributaries of Rae and Richardson Rivers. West of Rae River a poorly drained plain slopes down to Dease Arm of Great Bear Lake, giving access to Mackenzie River Valley.

Coppermine to Bathurst Inlet. Between Coppermine and Bathurst Inlet the Arctic mainland is more rugged than that to the westward. Rocky cliffs line the south shore of Coronation Gulf, except where broken by river deltas or stretches of gently rising coast. South of Coppermine settlement, Copper Mountains extend in linear ranges of hills with south-facing cliffs and gentle northward slopes terminating in drift-filled valleys. The mountains are formed by a series of superimposed flows of basaltic lavas. Altitudes reach 1,500 feet, but in general the relief is under 1,000 feet. A similar type of scarp and vale topography, with east- and southeast-facing escarpments, is found east of the central section of Coppermine River, and extends northward on the west side of Tree River.

North and east of the central section of Coppermine River the rugged, bare-rock hills become mantled with glacial drift. Subdued rolling topography, with innumerable oval-shaped lakes, is characteristic of the area around, and eastward of Contwoyto Lake. An area of rough bare-rock hills rises above the drift mantle north of the central part of Hood River. Eskimos hunt and trap over the rolling areas in winter, but avoid the rugged sections.

Bathurst Inlet extends 130 miles southward into the rugged Canadian Shield, and is bordered by steep rocky hills rising about 1,000 feet directly from deep water. Numerous large and small islands are scattered across the inlet and almost block its mouth. The structural

control of the inlet is indicated by the fault escarpment extending southward along the valley of Western River. The plateau edge on both sides of Bathurst Inlet is dissected by steep-sided rocky canyons, and falls and rapids are found inland along the stream valleys.

Kent Peninsula to Adelaide Peninsula. Elevations decrease east of Bathurst Inlet as the knobby hills and rock-ribbed topography with linear lakes and rectangular drainage merge into rolling hills of glacial deposition with oval lakes. Kent Peninsula is low along the west and north coast. Along the south coast its gentle beaches rise from shallow waters to rocky hills and steep south-facing escarpments. The neck of the peninsula is hilly, and the islands offshore to the east are the submerged tops of more hills.

The south coast of Queen Maud Gulf is a plain of marine deposition, with low knobs of Precambrian rock jutting through the poorly drained lowland. Numerous small rocky islands and unmapped shoals extend offshore into shallow water making navigation hazardous. Inland, the rolling hills are mantled with glacial drift, and several long rivers, some of them entrenched, cut through the area to the coast. The divide between these rivers and Back River is composed of low glacial hills south of MacAlpine Lake and bare-rock hills at the headwaters of Armark River.

The main features of Adelaide Peninsula are the gravel beaches parallel with the coast, the north-south alinement of drumlinoid and lake topography in the interior, and an overall low elevation. Off the shallow northwest coast, the tops of the drumlin hills form a group of islands.

Back River rises in drift-covered hills northeast of Great Slave Lake and flows north and east through a low featureless plain that has numerous sandy areas and long eskers. Northward the lowland merges into the rocky hills of the Bathurst Upland and the drumlinoid hills south of Queen Maud Gulf. Southward the plain is continuous to the upper Thelon River, but low bare-rock hills southeast of Garry Lake form the drainage divide between Back River and the lower Thelon tributaries. The Eskimos of this area migrate widely over the plain, but as they seldom come out to the coast, they remain a little-known, primitive people.

Chantrey Inlet and Boothia Peninsula. Chantrey Inlet has hills of glacial deposition to the west, and rocky Precambrian hills to the east rising abruptly along the central east coast. Glacial drift mantles the surface west and north of Hayes River, but east of the river bare-rock hills appear above the drift and become the dominant topographic feature. Between Chantrey Inlet and Shephard Bay the coast of Rae Strait decreases in altitude to a low wet plain.

The west coast of Boothia Peninsula, north and northwest of Josephine Bay, is low and marked by a series of emerged beaches parallel with the shore. Rugged hills of rounded, weathered, Precambrian granite and gneiss rise abruptly above the lowland and occupy the eastern part of the peninsula. On the west coast of the peninsula this fractured and faulted upland rises steeply from the sea south of Lord Mayor Bay and reaches its highest altitude of about 1,500 feet around Thom Bay. Fortunately, elongated lakes occupy a lowland between Lord Mayor and Spence Bays, permitting movement between the opposite coasts of the peninsula. North of Moltke Bay, the east coast has a low, sloping foreland fronting steep rocky hills. These barren hills and north-south ridges extend northward to Bellot Strait, where they form the most northerly point on the mainland of North America.

### Western Arctic Islands

The Western Arctic islands, part of the Western Arctic region, consist of King William Island, Prince of Wales Island, Victoria Island, and Banks Island.

King William Island is low and generally under 300 feet in altitude, except for a small conical hill east of Gjoa Haven and slightly higher land in the northwest corner. The surface is mantled with broken sedimentary rock and glacial deposits, whereas the coast consists of broad terraces marking former beaches. Countless lakes fill the depressions above the permanently frozen ground. Shallow water extends offshore in most places, especially along the northeast coast.

Prince of Wales Island has three physiographic divisions. A low coastal plain, with raised beaches, occupies the southwestern area between Ommanney and



Plate 2. Barren Grounds topography



Plate 3. Cambridge Bay, Victoria Island

Guillemard Bays and is covered with numerous small shallow lakes. Much of the surface consists of disintegrated, angular sedimentary rock in low, flat ridges or domes. Vegetation is unusually sparse. Another flat plain, also characterized by emerged beaches, fronts an escarpment on the northwest corner of the island. The central part of the island is a plateau of 500 to 1,000 feet altitude incised by numerous streams along the eastern side. There are very few lakes in this section and many of the stream beds are broad, shallow, gravel-filled valleys. A red, sedimentary escarpment rises abruptly above a narrow lowland west of Browne Bay and swings westward to the east and northeast side of Ommanney Bay. The northeastern part of the island and the large islands blocking the east side of Browne Bay are high and rugged, reaching an altitude of about 2,000 feet in the north. This rugged section is possibly underlain by Precambrian rocks similar to those that appear on nearby northwestern Boothia Peninsula and western Somerset Island.

Victoria Island. The eastern half of Victoria Island is similar in appearance to King William Island and southwestern Prince of Wales Island. A low shelving coast rises in gravel ridges and drumlinoid hills to rolling, lake-dotted country. Outstanding hills are only a few hundred feet high - one of the most notable, Mount Pelly near Cambridge Bay, is 675 feet in altitude and probably consists of unconsolidated glacial material. The south coast is also low, except for bluffs east of Cambridge Bay and low rugged hills at Richardson Island off the south coast where Precambrian rocks appear. The eastern interior is covered with innumerable oval, shallow lakes as far westward as the head of Prince Albert Sound. The lakes and glacial drift pattern have an east-west trend in the south and central area but a north-south trend in the northeast. Because of the ice-bound coasts to the north and east, these shores have never been travelled by ship, and only seldom by dog-sled. Information concerning the interior has only become available from aerial exploration after the World War II.

Elevations are higher in western Victoria Island, reaching altitudes of about 1,700 feet in the interior of Wollaston Peninsula, but decreasing towards Prince Albert Sound. The hills consist of irregular ridges of unconsolidated material, with "pingoes" in the more westerly sections. North of Prince Albert Sound ridge

and valley topography is characteristic. The broad linear valleys trend generally to the northeast and are separated by rocky ridges, some with perpendicular, north-facing, columnar cliffs of Precambrian trap rock. Altitudes up to 1,000 feet are common, and south of Minto Inlet may reach 1,500 feet or more. Both sides of the inlet are flanked by escarpments, which in places form prominent headlands. Extending inland north of Walker Bay and sloping gradually down to Collinson Inlet there is a generally rolling plateau whose surface is marked by a few lakes, and streams with a dendritic pattern, viz., one that resembles the veins of a leaf.

The surface of the belt of northeast-trending ridge and valley topography appears as high and precipitous cliffs at Wynniatt Bay and on the northwestern side of Hadley Bay. Many small rocky islands, the submerged crests of this range, are found offshore in the bays. The lake-covered uninhabited lowland, with emerged gravel beaches, extends south of Hadley Bay and is similar to the rest of eastern Victoria Island. Northeastern Victoria Island is a separate large island with steep bluffs on the west, and a low swampy coast on the east.

Banks Island is generally high and rolling and marked by high cliffs on both the north and south coasts. The highest altitudes in the Western Arctic are found in the south of the island where the trap rock of Nelson Head, the southern cape, rises a sheer 1,000 feet from the water, and where inland the peaks reach altitudes of about 2,400 feet. On the north coast, precipitous cliffs of soft sedimentary rock rise about 600 feet above sea-level, with steep-sided ravines and small canyons cutting back into the plateau front. The interior upland is notably lacking in lakes, and the large rivers have a well-developed dentritic stream pattern.

The west side of Banks Island has a low, poorly drained coastal plain that rises gradually inland to low rolling hills in the south-central area. The hills are separated by broad river valleys with abundant grassy tundra vegetation, in marked contrast to most parts of the Arctic. The east coast is low in the central section and has numerous small lakes. The northern and southern plateaux have less vegetation than the central section.

The western lowland supports a large white fox population, which has been trapped intensively by a few Eskimos who crossed from the Mackenzie River delta.

## The Eastern Arctic

### Eastern Arctic Mainland

In general, the Eastern Arctic mainland consists of an interior rocky plateau highest east of Great Slave Lake, a lower drift-covered upland to the eastward, and a coastal plain of marine and glacial deposition sloping towards Hudson Bay.

Churchill to Chesterfield Inlet. The lowland region west of Hudson Bay is one of countless lakes. A marshy, tundra plain broadening north of Churchill extends inland with gradually increasing elevations to beyond the upper Kazan River and Dubawnt Lake. South of Tavani the low coast is fringed with wide tidal flats, and ancient raised beachlines, behind which are linear lakes parallel with the coast and extending several miles inland. Lakes are very numerous south of Eskimo Point, occupying perhaps 50 per cent of the area. North of Eskimo Point the inland lakes are larger and the linear pattern of the surface deposits is more definite. The alinement of lakes is due to the manner in which surface material (glacial drift) was deposited as the ice retreated after the Ice Age, and the lowland has been compared to an undrained ploughed field after a heavy rain. The lakes fill depressions above the permanently frozen subsoil and have very little connected drainage. The main rivers consist chiefly of numerous large and small lakes joined by stretches of rapids and swift-running water. Travel over this lowland in summer is very difficult, but in winter the frozen lakes and snow-covered tundra permit easy movement.

The plain is cut by a non-continuous band of rocky hills, 300 to 500 feet high, which extends from Rankin Inlet and Tavani on the coast, through the Padlei area, to Kasba Lake on the southern Keewatin-Mackenzie boundary. Rocky hills appear periodically along this zone and in other local regions south of Dubawnt and Angikuni Lakes, serving only to emphasize the monotonous drift cover of the rest of the region. It is along this line of Precambrian rock hills that prospecting has found encouraging mineralization.

The uniformity in the levels of the emerged beaches in the central Thelon River area, and the water-worked appearance of drumlinoid hills and glacial drift west of Dubawnt River, suggest that a large glacial lake once occupied the area along the Mackenzie-Keewatin boundary. It may have formed when the ice-cap lay in eastern Keewatin District cutting off drainage from the eastward slope of the Canadian Shield east of Great Slave Lake.

The northern boundary of the coastal lowland is roughly along the Chesterfield Inlet-Baker Lake line. Inland along Schultz, Aberdeen, and Beverly Lakes the boundary follows the contact between hard, rugged Archaean rocks northward and less resistant sedimentary rocks to the south.

Chesterfield Inlet to Rae Isthmus. North of Chesterfield Inlet a rock plain extends inland in barren ridges seldom exceeding 200 to 300 feet in altitude, with narrow lakes occupying the hollows between the ridges. Glacial drift becomes more apparent north of Daly Bay and along the coastal plain south of Wager Bay, subduing the rugged topography. North of Wager Bay the coastal plain broadens, and ancient beaches, swampy marine deposits, and water-worked glacial features are all similar to the features of the broader coastal plain between Churchill and Eskimo Point. In winter the frozen coastal plain and generally smooth ice of Roes Welcome Sound are used as a highway for dog-sled travel south of Repulse Bay.

Inland from Roes Welcome Sound the topography shows the dominating influence of the bedrock. At the head of Wager Bay rugged hills of Precambrian rocks reach altitudes of 1,500 to 1,700 feet. This upland surface slopes down to the west and north, with glacial drift becoming progressively deeper in the valleys until it mantles the slopes. The more rolling topography merges gradually with sand plains around Back River, wet lowlands along Rae Strait, and the monotonous limestone plain of Simpson Peninsula.

Melville Peninsula. The barren upland of Precambrian rocks extends northward through Rae Isthmus into Melville Peninsula. The southern part of the peninsula is similar to the bare-rock plain located north of Chesterfield Inlet. Glacial drift or narrow lakes are found in most of the typical east-west valleys, but the ridges are

bare and rise to about 200 to 300 feet. Elevations increase to the northwest where a steep, rugged coastline fronts on Committee Bay. Barren hills reach an altitude of 1,000 feet, rising directly from the water, and relief is greatest near the coast where rivers that flow in fault-controlled valleys cut through to the sea. North of Garry Bay the relief is modified by greater glacial deposition, and lakes are oval rather than linear. The drift pattern and lakes have an east-west trend. Barren rugged hills cut by deep east-west valleys rise again on the south side of Fury and Hecla Strait.

The central east side of Melville Peninsula is low and is underlain by sedimentary rocks of Ordovician age. Southwest of Parry Bay the lowland, mantled by glacial drift, extends inland about 50 miles and terminates in an east-facing escarpment of Precambrian rocks. The lowland narrows west of Parry Bay where the escarpment rises steeply along the west side of Hall Lake. The lake-covered lowland ends abruptly at Hooper Inlet, where glacially rounded Precambrian hills rise on the north side. Eskimos live along the low east coast, but are seldom found along the rugged west coast.

Ungava Peninsula. Ungava Peninsula of northern Quebec is rocky Precambrian plateau mantled by glacial drift of varying thickness and dotted with innumerable lakes. The upland rises spectacularly to altitudes of 1,000 to 2,000 feet along the steep Hudson Strait coast. Fiord valleys indent the coast at intervals and give access to a rolling interior. South of the Hudson Strait coast the upland slopes gradually down to lower rolling topography subdued by glacial deposition. More Eskimo inhabitants live along the lower west coast of Ungava than along the steep north coast, where they are found chiefly in the sheltered fiords.

Parts of the Hudson Bay coast are low and poorly drained; in other places the coast rises through a series of rocky hills to an interior plateau. The uninhabited plateau slopes gradually down towards the lowland around Ungava Bay in the northeast, and the drainage divide lies close to the Hudson Bay and Hudson Strait coasts. The plateau surface is composed of rolling glacial hills or bare-rock ridges rising only a few hundred feet above the general level and separated by broad valleys containing lakes or glacial fills of boulders and gravel.



Plate 4. The Hudson Bay coastal plain



Plate 5. Devon Island near Dundas Harbour

## Eastern Arctic Islands

The Eastern Arctic islands consist of Baffin, Bylot, Somerset, the islands of northern Hudson Bay - Southampton, Coats, Mansel, Nottingham, and Salisbury - and the islands of Foxe Basin - Prince Charles, Air Force, and Foley.

Baffin Island, the largest of the Canadian Arctic islands, has an area of about 200,000 square miles - almost the size of the province of Manitoba. In such a vast area, a variety of topographic features are found, and some of them present the most spectacular scenery of Eastern Canada. Along the northeastern coast of the island, a high rugged mountain range of Precambrian rocks rises to altitudes of about 9,000 feet in places, and averages over 5,000 feet. These mountains are, therefore, along with those of northern Ellesmere Island, the highest ranges in eastern North America. Jagged peaks and serrated ridges are partly buried under permanent snow-fields and ice-caps, and long twisting glaciers fill many valleys, discharging into the sea at several places. The whole coast, with its indentations and fiords, rises abruptly from the water, presenting a formidable barrier of rugged grandeur towards Davis Strait and Baffin Bay. The range is less spectacular from the west where it slopes gradually down to a barren rocky plateau merging with the lowland along Foxe Basin.

Southern Baffin Island has a barren rocky coast, which rises to an altitude of about 1,000 feet. A belt of numerous small islands, the submerged peaks of rocky hills similar to those of the mainland, fronts the central part of the south coast. Most of the interior is a rough barren plateau that averages 2,000 to 3,000 feet in elevation. The upland slopes north and west to a broad, poorly drained, tundra plain that covers the area west of Amadjuak and Nettilling Lakes and extends along the Foxe Basin coast as far northward as Hantzsch River. This lowland supplies food to the only notable herds of caribou found on Baffin Island. The lake-dotted and swampy plain is similar in appearance to the emergent coast on the west of Hudson Bay. Low, featureless islands of disintegrated limestone lie offshore in the shallow waters of eastern and northern Foxe Basin.

Northwestern Baffin Island differs in topography from the rest of the island because it is characterized

by generally flat-lying strata rather than rugged Precambrian granite and gneiss. Brodeur and Borden Peninsulas are level uplands, cut by narrow ravines near the coast, and with few lakes. These cold barren uplands have very few caribou and are shunned by the Eskimo. The coastal ravines and interior rivers permit travel across the peninsulas along a few well-known routes. The coasts along Admiralty and Prince Regent Inlets are vertical walls of stratified rock, rising to altitudes of 500 to 1,000 feet. Southward the topography is more rolling where hills of Precambrian rock rise above the glacial mantle. North of Fury and Hecla Strait the hilly country is not as rough as the rugged region south of the strait.

Bylot Island is a continuation of the precipitous mountain topography of northeastern Baffin Island. Sharp-peaked mountains jut through an interior ice-cap, and valley glaciers discharge small icebergs into the sea. A low narrow foreland fronts the mountains on the northwest, and a broader lowland occupies the southwest area.

Somerset Island is similar to the sedimentary plateau of northwestern Baffin Island. Horizontal walls of rock, cut by occasional sharp ravines, rise vertically from the sea. The level to rolling interior is mantled with angular, frost-riven fragments. A broad valley lowland extends northwest of Creswell Bay, separating the plateau from the range of Precambrian rock hills along the central and southwest coast. The reddish coloured rocks of north-central Somerset Island are similar in appearance to those of northern Prince of Wales Island.

Southampton Island, about 20,000 square miles in area, has two distinct physiographic regions. The larger part, southwest of a line drawn roughly from Duke of York Bay in the north to the southeastern corner of the island, is low flat limestone country characterized by sloping terraces that mark ancient emerged beaches. Long rivers empty into shallow offshore waters, and small lakes and marshes are numerous. To the northeast, rugged Precambrian hills rise abruptly above the limestone plain to altitudes of 1,000 to 1,500 feet. The northeast coast is steep, rugged, and indented.

Coats and Mansel Islands have flat or gently rolling, disintegrated, limestone surfaces. A narrow belt of Precambrian rock hills occupies the eastern end of Coats

Island. Mansel Island is a featureless, almost barren, lowland of frost-riven limestone fragments.

Nottingham and Salisbury Islands, at the western end of Hudson Strait, are composed of Precambrian rocks. Their steep, barren, indented coasts rise abruptly from the water to a uniform level upland of a few hundred feet altitude. Linear valleys and rocky ridges are characteristic of the interiors.

Prince Charles, Air Force, and Foley Islands. Only vaguely seen previously in 1948, these islands in Foxe Basin were first photographed from the air. In the summer of 1949, a party sent out by the Geographical Branch, and headed by T. H. Manning, explored them. The total area of the three islands is approximately 6,000 square miles, most of which is made up of swampy lowland formed by disintegrated limestone. The northern parts of the islands have a somewhat higher relief, granite hills rising to 300 feet along the north coast of Foley Island.

### The Northern Arctic

The third major region of the Canadian Arctic consists of the islands that lie north of Viscount Melville and Lancaster Sounds. They include Devon, Ellesmere, Axel Heiberg, Ellef Ringnes, Amund Ringnes, Borden, Mackenzie King, Brock, Prince Patrick, Melville, Bathurst and Cornwallis Islands.

Devon Island is a high plateau that has a large ice-cap occupying its eastern half discharging picturesque glaciers into fiord valleys and the sea. Steep, Precambrian rock cliffs and glacially eroded peaks complete the scenic setting of the east and southeast coasts. The central and western parts of the island are underlain by horizontal sedimentary rock that rises 1,000 feet in vertical cliffs directly from the water. Numerous long, narrow inlets, backed by V-shaped ravines, have cut notches into the level upland and interior. The plateau slopes down to the west and north, where, in places, a narrow foreland faces Wellington Channel and Jones Sound. Grinnell Peninsula in the northwest has rugged, more dissected, hilly topography. Because of the high barren character and steep coasts of the island, wildlife is very scarce on the land, and it has not been a favourable location for Eskimo settlement.

Ellesmere Island, with an area as great as the three Maritime Provinces and Gaspe Peninsula, extends from Jones Sound to within 500 miles of the North Pole. The island is an uplifted plateau with a surface sloping westwards, so that elevations in the east are generally higher than in the west. The interior is rugged and mountainous and much is occupied by ice-caps. There are few lakes, and rivers flow in well-defined, sometimes deeply cut, valleys or ravines.

Topography of the southern part of the island is similar in pattern and form to Devon Island. The coasts are highly indented and backed by steep mountains rising to 3,000 feet, except in the west where there are some lowland sections, particularly in the Bjorne Peninsula area. North and south of Baumann Fiord there is a general east-west trend to the topography, but to the north, in Fosheim Peninsula and the area between Bay and Canyon Fiords, valleys and escarpments run north and south.

Northern Ellesmere Island is mountainous with peaks in the United States and British Empire Ranges reaching elevations of 9,000 feet or more. The coast is rugged and deeply indented, with fiords extending many miles inland. Owing to the rugged topography and the long period of winter darkness, Ellesmere Island has not been inhabited by Eskimos within recent historical times. Ruins of old houses, however, indicate that Eskimos once lived there, perhaps occupying the sites while migrating to Greenland from the more southerly Arctic islands.

Axel Heiberg Island is ice-capped and mountainous in the interior, its jagged topography being similar to northern Ellesmere Island. The west coast has a rough hilly belt between the mountains and the sea, above which rise flat-topped mesa-like hills of sedimentary rock. The northeast coast along Nansen Sound is low, broken only by rock ridges that extend inland at right angles to the shore.

The Ringnes Islands have a complex topography owing to folding and later erosion of the sedimentary strata. Ellef Ringnes Island has at least four, large, dome-like features in its interior. Concentric, inward-facing escarpments are being eroded by streams that have breached the ridges in places. In other areas, outward-facing escarpments are noticeable. Several rivers that empty

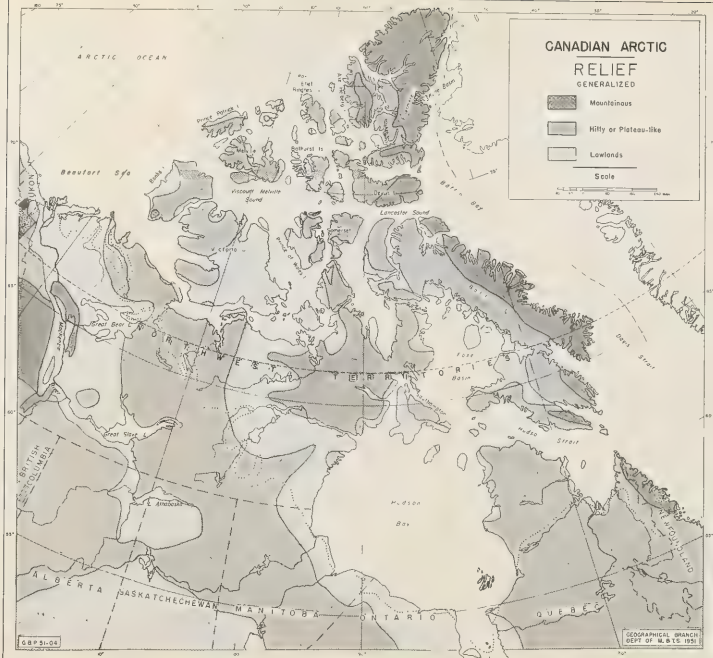
into the south-central coast meander in braided channels through flat-bottomed valleys that have perpendicular, rocky walls. Isachsen Peninsula, to the northwest, is a low plateau greatly dissected by many streams, and in appearance is very similar to Prince Patrick Island.

The southern half of Amund Ringnes Island is low, and has numerous streams flowing across the gently sloping surface from the central interior. The northern part of the island has curving escarpments that are similar to those found on nearby Ellef Ringnes Island. Like most of the far northern Arctic islands, there are virtually no lakes on the Ringnes group. As the islands are ice-bound for most, and perhaps all, of the year, no ship has ever penetrated to their shores. Prior to 1947, only a few white men had ever seen the coasts and no one had visited the interiors. There is as yet no record of Eskimo camps on these very inaccessible islands.

Borden Island is low on the west and north with gently rolling slopes drained by many dendritic streams. Shallow water and many small offshore islands fringe the north coast. The east coast has several lagoon lakes, the only ones on the islands, cut off from the sea by narrow sand bars. The southeastern part of the island is rough and hilly and is separated from the rest of the island by a northeast-trending, narrow river valley.

Mackenzie King Island has a rocky core of dissected hills and small canyons from which streams radiate outward to the low, shelving coasts. The north coastal plain has a distinctive, small, turret-shaped hill that stands out above the sloping well-drained plain. Nearby Brock Island has a rough dissected upland on the southeastern side, built of dark-coloured rocks similar in appearance to those of Prince Patrick Island and southeastern Borden Island. The west coast is low, with drainage similar to western Borden Island, and is fronted on the Arctic Ocean by high, gravelly, ice-shove ridges. The Stefansson party, which discovered the Borden group of islands in 1915-16, is the only expedition to have set foot on this land.

Prince Patrick Island is an eroded upland of sedimentary rock, generally under 500 feet in altitude, in which structurally controlled features are apparent. The remnant areas of the level barren upland have scalloped





edges where steep-sided ravines are being eroded by the many streams. The amount of active erosion that is possible upon the bare, frost-riven rock is illustrated by the deltas that fill most river mouths. Such erosion takes place chiefly while the snows are melting in June and early July and while the small streams are running in August.

Melville Island is a sedimentary rock plateau, of about 1,000 feet altitude, whose level upland of frost-riven fragments has been little disturbed by streams. Broad inlets with perpendicular walls form numerous peninsulas and give the island a very irregular shape. Many of the coastal mountains marked on early maps are simply the high eroded edges of the level upland. Steep-sided ravines are cutting back from the inlets in a few places, but only in one area along the central west coast has the dissection caused "mountainous" topography. Hilly country that is lower than the plateau extends inland from Winter Harbour to Liddon Gulf. A narrow, sloping lowland lies along the east coast facing Byam Martin Channel, and another fronts the plateau south and west of Hecla and Griper Bay. A broader lowland occupies the southern part of Sabine Peninsula. On these lowlands many emerged beaches are now found far from the shore, indicating a rise in the level of the land. Notable features are the distinctive, circular, inward-facing escarpments of northwestern Sabine Peninsula; the elongated dome southwest of Hecla and Griper Bay; and the west-facing escarpments near Weatherall Bay on the northwest coast.

Bathurst Island is rolling to hilly, with some areas of sloping coastal plains. It is highest on the east coast, with a rolling interior plateau crossed by mature stream valleys. The lakes in the south-central part are some of the few found in the northern Arctic islands. The southwest coast slopes down gently to the sea and is characterized by gravelly ridges marking emerged beaches.

Cornwallis Island is similar to Bathurst Island in that it is rolling to hilly. It slopes up from the sea along the south coast in terraces of barren disintegrated rock. The higher land on the east coast slopes through the rolling, well-drained interior to the west coast.

## CHAPTER II

### PHYSICAL GEOGRAPHY: AIR AND WATER

#### CLIMATE AND WEATHER

In climatic terminology an Arctic region is one in which the average mean temperature for the warmest month is less than 50° F. In Northern Canada the isotherm delimiting this area is generally a short distance north of the tree line. The harsh climate of the Arctic combines with the disadvantages of rocky topography and lack of soil to make the region a difficult one for development. The distribution of the Arctic climate is very uneven. It does not follow the latitudes equally from west to east. In western North America warm currents in the sea and air move from the southwest up the Pacific coast and so carry temperate climates far to the north. The Arctic climate is, therefore, restricted to the extreme northwest. In eastern North America there is a southeasterly movement of weather and ocean currents that has extended the Arctic climate far south into the eastern mainland of Canada, to latitude 60 degrees on the west side of Hudson Bay and to about latitude 57 degrees on the east. The latter is about 10 degrees, or 700 miles, south of the Arctic Circle, and about the same latitude as the good farming region of the Peace River of northwestern Canada. The general climatic conditions are those of long cold winters and short cool summers.

Arctic climate is of far greater importance than might be supposed because the source of much of the

weather affecting the mid-latitude regions of North America and the North Atlantic Ocean is in the Canadian Arctic. In winter, cold air masses from the Arctic Ocean move southward up the Mackenzie Valley and southeastward over the Arctic islands towards Hudson Bay and Hudson Strait. They affect the weather as far south as the Appalachians and the Ozarks, and sometimes send icy winds down to the Gulf of Mexico. In summer, these air masses are much weaker and do not spread as far south. When they do move, they tend to follow a southeastward course. They are not prevalent in the west as the Mackenzie is invaded by warm air masses from the south. Meteorological stations scattered throughout the Arctic record these air mass movements and forward the information by radio to more southerly and easterly stations where it is useful for forecasting coming weather in the mid-latitude regions.

The cold air masses of the north come into conflict with warm air masses from the south to produce cyclonic storms, which sweep across Canada throughout the year. These storms tend to be more numerous in winter than in summer and to be concentrated in southeastern Canada, particularly in the St. Lawrence lowlands region where the cyclone tracks converge and produce highly variable weather conditions.

### Temperatures

Whereas there is not much difference in winter temperatures throughout the whole of the Canadian North, the northeastern (or Arctic) part remains cool in summer, while the northwestern (or sub-Arctic) part experiences warm weather.

Winters in the Arctic have the lowest average monthly temperatures in Canada, although the extreme minima are not as low as those recorded in northwestern Canada. The coldest area is northwest of Hudson Bay, where January and February average below  $-25^{\circ}$  F. at Chesterfield Inlet, Pond Inlet, Cambridge Bay, and Baker Lake. It may be still colder within this circle of stations, but no meteorological data are available. In the Hudson Bay and Strait area mid-winter temperatures range from  $0^{\circ}$  F. near the open water off Resolution Island to  $-20^{\circ}$  F. on both sides of ice-covered Hudson Bay. However, in early winter, before the ice has formed, the east side of

Hudson Bay is notably warmer than the west side. In the Western Arctic, January and February monthly averages range from  $-15^{\circ}$  F. to  $-20^{\circ}$  F. At most of the Arctic weather stations (exclusive of those in the far northern Arctic islands), monthly temperatures average below  $0^{\circ}$  F. for 5 to 7 months. In the Hudson Bay area, for example, temperatures are almost continuously below freezing after mid-October, and begin to rise above freezing again in May.

Because the Arctic has a great many ice-covered channels, and occasional open water, winter extreme minimum temperatures are not as low as those recorded in the interior of Canada. This marine influence also delays the coldest period to the month of February. Extreme minimum temperatures of  $-50^{\circ}$  F. are recorded at most of the stations at some time during the winter. A record low of  $-63^{\circ}$  F. has been reported at Cambridge Bay, and minima of  $-62^{\circ}$  F. at Baker Lake and  $-60^{\circ}$  F. at Pond Inlet and Chesterfield Inlet are other extremes. Temperatures several degrees colder have been noted in the Canadian Northwest and on the northern Prairies. Although Arctic extremes are not as severe as in the Northwest, the winters are continuously cold with no thaws.

The 4 months of June to September have average monthly mean temperatures above  $32^{\circ}$  F. in most of the Arctic. This, however, does not mean that temperatures below  $32^{\circ}$  F. do not occur within this period. On the contrary, they frequently do, and, in reality, the frost-free period is quite short. Chesterfield Inlet, which has the longest frost-free period of any of the Arctic stations, has an average of 67 days without frost, but there is great variability from year to year. First autumn frosts have occurred there as early as August 2 in one year and as late as September 17 in another. Autumn frosts usually occur earlier on the east side of Hudson Bay, where the cold influence of Hudson Bay, aided by northwest winds, is more dominant. Port Harrison has an average of only 44 frost-free days. Similar short frost-free periods are found on Baffin Island and in the Western Arctic, where the average last spring frost occurs in late June and the average first autumn frost comes in mid-August. At the northern post of Pond Inlet there is an average frost-free period of only 30 days, with freezing temperatures recorded in every month.

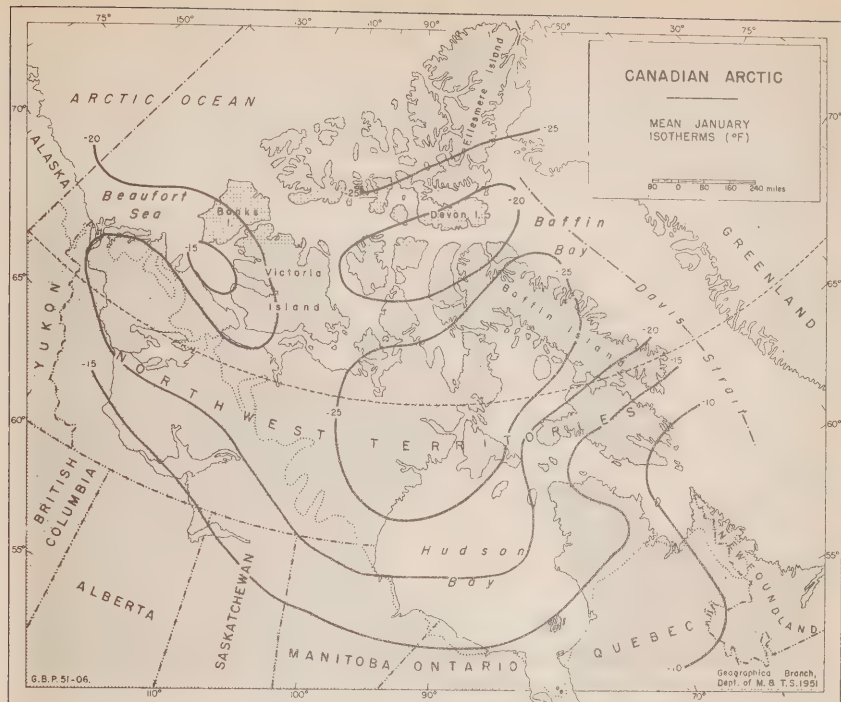


Figure 5. Mean January isotherms.

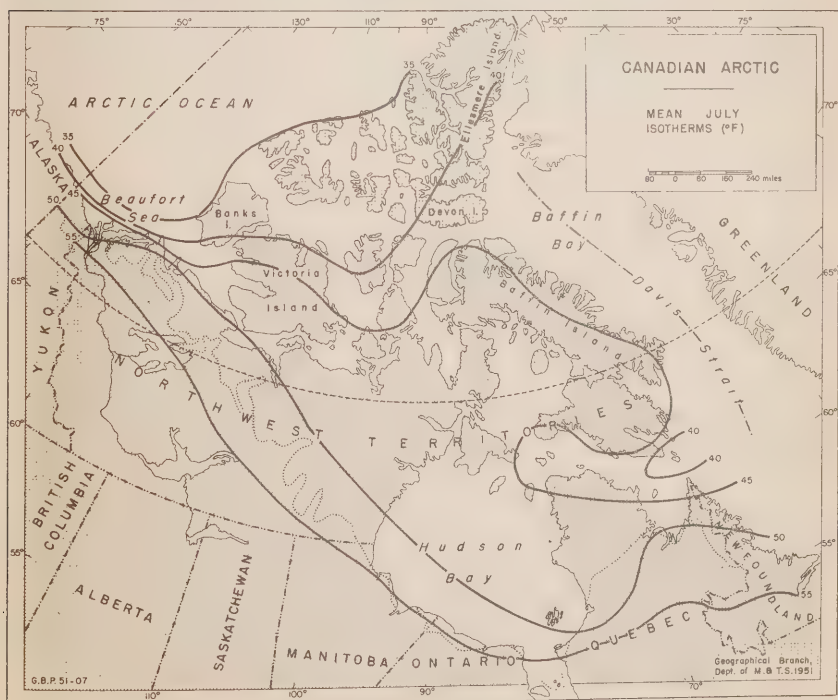


Figure 6. Mean July isotherms.

During the short period of growth, vegetation comes to life in valleys that contain soil, flowers blossom forth in colourful beauty, and myriads of mosquitoes swarm over the low wet areas. Average daily maximum temperatures are in the cool 50s in July and August and daily minima are 10 to 15 degrees lower. Extreme maxima of over 70° F. have been known at most stations. Record highs of 87° F. (Coppermine) and 86° F. (Chesterfield Inlet) were recorded on the southern edge of the Arctic. On Hudson Strait, 81° F. has been reached at Lake Harbour and Cape Hopes Advance.

When the difficulties of a short growing season are combined with a lack of developed soil, it is apparent that agriculture under natural conditions is not possible in the Arctic.

### Precipitation

Precipitation is light over most of the Arctic. Southeastern Baffin Island receives the greatest amount of precipitation from moist winds that blow in from the North Atlantic. In this area approximately 8 inches of rain is evenly distributed throughout the 4 summer months. Seventy to ninety inches of snow are usually recorded in winter, with a maximum falling in the late autumn. The east coast of Hudson Bay has a greater amount of precipitation than the west owing to higher elevations and prevailing on-shore winds from Hudson Bay. At Port Harrison, on the east side of the bay, 16 inches, with an autumn maximum, are recorded, and at Chesterfield Inlet, on the west side, the average is 12 inches. In the Arctic islands an average of 2 to 4 inches of rain plus 30 to 60 inches of snow has been recorded. Most of the area records less than 10 inches of annual precipitation, and some stations have less than 6 inches. Snowfall is difficult to measure because of frequent drifting, and figures are only approximate. In sheltered locations several feet of fine granular snow may accumulate during the winter, whereas rock ridges may be bare. Snow melts from southern slopes in late May in the southern Arctic, and except for the permanent ice-caps, the Arctic is snow-free in July and August. Snows begin to fall in September in the northern parts, and snow-cover is usually sufficient for dog-team travel by late October or November.

## Winds

Prevailing wind directions are difficult to determine for the whole region. Most of the posts are located in sheltered bays or inlets where wind directions are controlled by topographic features. Upper air observations have been taken at only a few of the more recently established meteorological stations. Surface winter winds appear to come predominantly from the north or northeast at the far north stations, and blow generally from the west or northwest in the Hudson Bay and Hudson Strait area, and in the Western Arctic. Upper air observations show winds from every direction, but winds with a northerly component are dominant in winter. Arctic conditions are extended farther south by these generally northerly winds. During the summer months the southern half of the region is under the influence of weak cyclones. There is a variety of wind directions, but no particular prevailing surface wind. At upper levels northerly winds are most frequent, but are not as dominant as in winter.

Wind velocities are generally low during the summer and become stronger in the winter. Gales lasting several days may occur at any time during the winter months, but are most prevalent from October to December. Paradoxically, calms also occur most frequently in the winter when Polar air masses stagnate over the region.

## Fog

The prevalence of summer fog and low stratus clouds is one of the hazards of coastal navigation and flying in the Arctic. When relatively warm air from the land comes in contact with cold Arctic waters condensation and resulting fog occur. Meteorological stations on Hudson Strait report an average of 7 to 12 foggy days in each of the 4 summer months, with July usually the foggiest. There may be as many as 15 to 25 days of fog in any one month. Fogs are less frequent in the region west of Hudson Bay and in the Western Arctic. Low clouds are a particular problem confronting flying over the Arctic islands. Extensive cloud-banks persist over some of the large islands for days, becoming increasingly common in mid-August, blanketing all flying fields or potential landing lakes. During the winter, when temperatures over land and sea are more nearly equal, there is less liability to fog conditions.

## HYDROGRAPHY

There are twenty-four Canadian Arctic islands over 1,000 square miles in area, about fifty islands each larger than 100 square miles, and a large number of smaller ones. The straits, sounds, and channels that separate these islands vary in width from a few miles to over 100 miles, with the chief separating bodies of water averaging about 50 miles in width. Between the islands and through the channels, the general movement of water is from the north and northwest to the south-east.

### Currents

Ocean currents within the basin of the Arctic Ocean move with a general clockwise motion, passing southward into the Atlantic, and, to a lesser extent, into the Pacific. This cold water follows three main channels of movement through the Canadian Arctic islands, and each affects ice conditions in the short navigation season. One channel is the narrow north-south passage between Ellesmere Island and Greenland; the second is the broad east-west passage of M'Clure Strait to Lancaster Sound. Arctic waters thus move eastward and southward through the Northern Arctic islands and enter Baffin Bay via Smith and Lancaster Sounds. From Baffin Bay currents drift southward past the barren east coast of Baffin Island through Davis Strait, and along the coast of Labrador into the North Atlantic Ocean. The third main route of water movement is from west to east through the series of shallow gulfs and straits along the northern mainland coast. This current with the addition of water from M'Clintock Channel and Prince Regent Inlet passes through Fury and Hecla Strait into Foxe Basin.

A northward-moving current from the North Atlantic Drift (continuation of the warm Gulf Stream) merges with the cold current from east Greenland and flows northward along the west coast of Greenland through Davis Strait with relatively warm water at the surface. This current swings into the southward moving Arctic Current in northern Baffin Bay. A great contrast in climate is found in the same latitude on the opposite shores of Davis Strait owing to the temperature differences between the cold Arctic Current off Baffin Island and the warmer current touching the west coast of Greenland. The effect of this

contrast of ocean currents explains much of the past history of settlement and the present possibilities of these two nearby areas.

At Hudson Strait the southward-flowing Arctic Current branches westward around Resolution Island and moves along the south coast of Baffin Island. Near the western end of the strait this current meets waters moving south-eastward from Foxe Channel. The combined waters then drift back eastward along the south side of the strait, finally joining the Labrador Current. Some of the west-erly moving water of Hudson Strait enters Foxe Basin around Foxe Peninsula of Baffin Island and gives a general counter-clockwise motion to currents within the basin.

There is also a counter-clockwise current in Hudson Bay. Arctic waters move southward around Southampton Island through Roes Welcome Sound and Fisher Strait and along the west coast of the bay. The movement follows the general oval shape of Hudson Bay, flowing strongly northward along the east coast and joining the eastward-moving stream in southern Hudson Strait.

### Tides

Tides are only a few feet high in the Northern Arctic because the chief tidal influences have been spent by the time they reach the area. On the basis of a few records there is a suggestion that both eastern and western tidal undulations reach the Arctic islands. Off southern Cornwallis Island tides are 4 to 6 feet, and are somewhat higher eastward in Lancaster Sound. The tidal range decreases to the westward, being only about 1 foot at eastern Prince Patrick and southern Ellef Ringnes Islands. Tides are also low in the almost-enclosed seas of the southwestern Arctic. The spring tide at Cambridge Bay is only 2 feet. On the east coast of Baffin Island, however, in the fiords of Cumberland Sound and Frobisher Bay, tides reach heights of 20 to 30 feet owing to the tidal waters being propelled into narrow inlets. High tidal ranges make some shores difficult to approach, and certain inlets are hazardous for navigation.

The tides in Hudson Strait are complex and have a considerable range owing to Atlantic waters being funnelled into the narrow strait. Neap tides average 25 feet

and spring tides 33 feet at Ashe Inlet on the north side of the strait, and both tides range from 20 to 30 feet at various places along the south coast. In some places the spring tide range may be twice or almost three times the neap tide range, and the variation in successive spring tides may be as much as 8 feet. The variable tides offer no serious problems to ocean-going ships in the main channel, but present serious hazards to small coastal schooners. The tidal range decreases towards the western end of the strait and in the open areas adjacent to Hudson Bay.

In Hudson Bay most of the harbours are open to the sea and thus have no constrictions to increase the tides. Shallow water, however, increases the height of tides on the west coast compared with those on the east. At Churchill, spring tides vary from 13 to 17 feet. Similar tides are measured at the other west coast stations. The tidal undulation progresses in a counter-clockwise movement around Hudson Bay. At Port Harrison the influence is almost spent and tides of from 3 to 5 feet are recorded.

Foxe Basin has a strong tide from the south and a secondary one from the north through Fury and Hecla Strait. Tides of 4 to 5 feet have been observed at the recently discovered islands in central Foxe Basin. The shallowness of the basin accentuates the influence to heights of 12 to 16 feet along the Baffin Island coast.

### Sea Temperatures

Incomplete records of summer water temperatures in Hudson Strait and Hudson Bay indicate that there are both cold and relatively warm currents. Surface water temperatures on the north side of Hudson Strait hover around 32° to 34° F. during the summer, and are colder than those on the south side. In Hudson Bay, surface temperatures above 40° F. have been recorded in the coastal water, but in the central part of the bay, they are generally lower. It is believed that below 150 to 200 feet the waters are dynamically dead. Surveys of this cold body of salt water have indicated that it has very little fish food.

## ICE CONDITIONS

### Sea Ice

The direction of movement of drifting ice is the result of the combined forces of ocean currents and winds. Ice drifts along with the major ocean currents, but deviations from the normal may be caused at any time by changes in prevailing winds. As arctic weather varies from year to year as the weather does in mid-latitude regions, the ice conditions of any one season will be determined by the weather of that season.

In the far northern Arctic islands ice begins to form along the shores early in September. As the weather becomes colder the sea ice grows outward and the islands are joined together by solid ice, which has frozen from shore to shore. In winter, the far northern islands are joined by an ice bridge to the southern Arctic islands and Greenland. Open water is usually found at the eastern entrance to Lancaster Sound and extending eastward into the well-known "North Water" of northern Baffin Bay.

The few years of observation indicate that the ice does not break up in the summer, except that, in early August, narrow strips melt along the low coasts. The ice in the channels between Ellesmere Island and Greenland begins to break in August. The passage remains choked with southward-moving, grinding ice floes during the short summer, but open water may be found for short periods along coasts if off-shore winds prevail. No ship has been able to penetrate far into the heavy Polar pack-ice of Lincoln Sea. Jones Sound and Wellington Channel have open water in August and September, but heavy, moving floes block most of Norwegian Bay to the northward. Open water may be found off the western Ellesmere Island coast, particularly after east winds.

The ice in Barrow Strait begins breaking into large floes in late July or early August. In some years these floes may gradually break into smaller pieces and drift eastward into Lancaster Sound and southward along the coast of Baffin Island. In other years, particularly with easterly winds, the ice will move about in Barrow Strait without pattern or predictability. In Viscount Melville Sound the north side may have a strip of open water for a few weeks at the end of August, particularly

after northwest winds, but the south side is jammed full of large floes. In the few attempts made, no ship has been able to break through the heavy floes in M'Clure Strait.

In Baffin Bay and Davis Strait ice drifting southward from the channels between the Arctic islands is supplemented by numerous bergs breaking off principally from the glaciers of Greenland, and, to a much lesser extent, from those of the Canadian Arctic. This ice begins to spread southward in autumn, first in narrow strings, and later in broad floes and masses. By November pack ice has blocked the entrance to Hudson Strait and is joined there by more ice from the strait. By late December the floes appear off the coast of Newfoundland. The Baffin Bay pack ice is reported to reach its greatest extent in March and April. Ice moves northward along the southwest coast of Greenland, originating from the Polar Pack off East Greenland, a "middle pack" moves southward into Davis Strait, and the "west ice" follows the Labrador Current southward along the coast of Baffin Island. A belt of landfast ice builds outwards from the east coast of Baffin Island, beginning in late September. It may attain a width of 50 miles or more by April. The ice breaks up in July, but fields of loose ice of varying extent may remain off the coast throughout the summer. South of Cape Dyer the landfast belt is narrower, and open water is common in August and September.

Navigation within Baffin Bay depends upon the severity of the season. In some years, the bay is clear of ice during August and September, and in others, adverse winds may block the northern part with floes throughout the year. Drifting bergs or ice floes may be met at any time, but it is usually possible to reach the northern Arctic posts by travelling off the east coast of Baffin Island in late August and throughout September. The route along the west coast of Greenland offers fewer hazards and is usually ice-free in July. The northern Arctic islands may then be reached by crossing northern Baffin Bay whenever ice conditions are favourable.

In Hudson Bay and Hudson Strait the sea ice generally starts to form towards the end of October or early November building out from the shore for a distance of 5 to 7 miles, depending on the depth of water and the outline of the shore. Harbour ice attains a thick-

ness of about 5 feet during the winter, but outside the sheltered places storms may slide the masses over one another until such "rafted" ice may have a thickness of several tens of feet. The central part of Hudson Bay freezes over about January, with an open strip of varying width between this mass and the shore ice. The central mass of ice is formed by large and small pans finally jamming together and freezing into one sheet. Pressure ridges cross the ice in all directions, but are generally parallel with the shore towards the outer edges. The shore lead, or "floe edge", is generally wider and more persistent on the west side of Hudson Bay than on the east. The Eskimos from the Belcher Islands can usually cross the ice to the mainland in February and March. It is doubtful if James Bay freezes over completely; open water and moving floes have been reported in late winter in the north-central part of the bay. Hudson Strait has not been frozen over from shore to shore when observed. The channel is blocked throughout the winter, however, by heavy loose ice that moves east and west with the tidal currents.

In late June the sea ice along the coasts of Hudson Bay begins to break up and joins the general drift of the currents towards Hudson Strait and the North Atlantic. During part of July, Hudson Strait remains un-navigable for ordinary vessels as the ice moves outward. Prevailing winds determine the time of accessibility of most of the harbours. A period of westerly winds will tend to clear the ice out of the strait early in the season, whereas easterly winds will hold it back, and the accumulated ice will block the western end of the strait. Prevailing northerly winds tend to push ice into the harbours on the southern shore, delaying their opening; southerly winds will tend to block the north coast harbours. The route into Hudson Bay is generally free of ice during August, September, and most of October, permitting ocean-going vessels to navigate with freedom.

In the Western Arctic for about 9 to 10 months coasts are closed to sea transportation by landfast ice, and the gulfs off Beaufort Sea are jammed with heavy ice floes from the shifting pack of the Arctic Ocean. Navigation is possible during the short open season, when the ice moves away from the shores of the open coasts and melts in the enclosed seas. The length of that season, and the degree of accessibility, however, vary greatly from year to year.

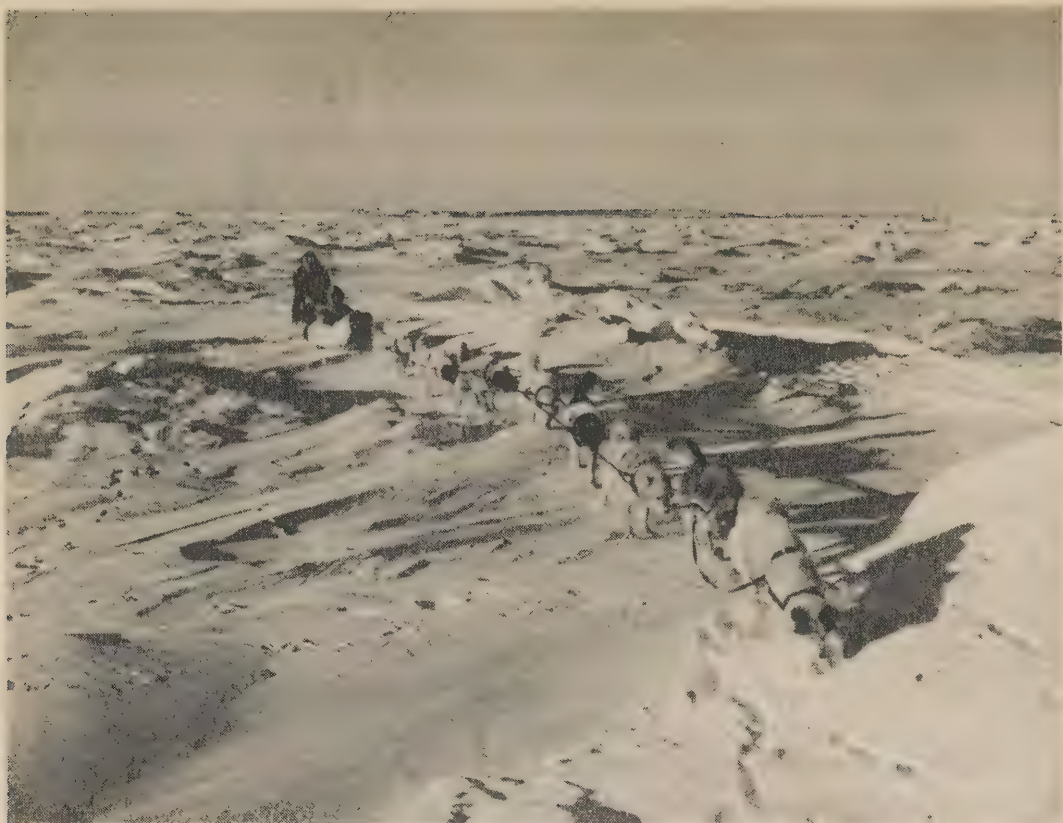


Plate 6. Hummocky ice near Churchill



Plate 7. R.M.S. *Nascopie* at Wolstenholme, Quebec

Towards the end of September or in early October ice forms across the harbours and inlets, and starts to build out from the shore. By the end of November, or early December, Coronation and Queen Maud Gulfs and the connecting straits off the mainland coast are frozen over except where there are unusually strong currents. If freeze-up comes during a period of calm, the ice will be hard and level, making an excellent winter highway. If the freeze-up period is stormy and the ice is broken up several times before finally setting, the resulting ice-cover will be rough and hummocky. In the Eastern Arctic, high tides raise and lower the harbour ice, leaving a zone of weakened ice or open water between the main mass and the shore. In the Western Arctic, on the other hand, tides are so minor that the harbour ice freezes solidly to the shore. This lack of a "tidal hinge" constitutes one of the notable distinctions in the winter ice of the Eastern and Western Arctic regions.

In spring the ice breaks up first along the coasts, especially near the mouths of rivers. A strip of open water melts along the shore, and cracks appear in the harbour ice. Soon the cracks grow wider, and the floes are shifted about with the wind. Finally, a strong off-shore wind will move the ice out of the harbour into the shifting mass in the main channels. The break-up occurs in the latter half of June, or early July along the mainland coast, and towards the middle of July in the islands.

After the harbour ice has moved out, it is still several weeks before navigation is possible along the coasts. The open coast of Beaufort Sea near the Mackenzie River delta and the coast south of Amundsen Gulf usually have a strip of open water by early August. At any time during the summer, however, strong northerly winds may push the heavy floes of Beaufort Sea southward against this mainland coast. Westerly winds may block the harbours and inlets of western Victoria Island throughout July, and may jam Dolphin and Union Strait. In some years the latter strait has been blocked with ice floes throughout the summer, but this barrier is not common. Prince of Wales Strait between Banks and Victoria Islands, has been reported open in late August in some years, and jammed full of floes from Viscount Melville Sound in other years.

By the end of July, Coronation Gulf usually has enough open water for navigation. The floes move about with the winds in the central part of the gulf until they melt. In shallow Queen Maud Gulf the ice remains until the latter part of August. At any time heavy polar ice from M'Clintock Channel may push southward through Victoria Strait and into Queen Maud Gulf. Simpson Strait, south of King William Island, is too narrow for polar ice to enter so that this strait and the channel to the eastward are open in August.

North of King William Island there is no ice-free season. Heavy polar ice from M'Clintock Channel pushes southward throughout the year, and having no outlet, jams into Victoria, James Ross, and Franklin Straits. Only occasional navigation by shallow-draught vessels has been possible off the west coast of Boothia Peninsula, in particular when favourable winds hold the pack ice off the coast. Peel Channel apparently has some ice throughout the summer, but in some seasons it has been loose enough to permit schooner navigation.

### River and Lake Ice

The dates of break-up and freeze-up of the lakes and rivers in the Arctic are important factors in the accessibility of the region, especially for ski- or pontoon-equipped aeroplanes. The river ice on the Arctic mainland breaks up in middle or late June; floating ice may be found for several weeks after the beginning of break-up.

Size and depth of lakes are factors affecting the time of break-up. The smaller lakes usually clear first. Most lakes on the mainland are free of ice by the middle of July. The large ones, however, may contain floating ice long after break-up if their outlets are not large enough to carry away the floes. Drifting ice has been known to remain in some of the lakes until early August. This ice is moved about by winds so that pontoon-landings by aeroplanes are often possible on the windward sides of lakes. On the southern Arctic islands, lakes may still be frozen over in early August. It is likely that the few lakes in the far northern islands do not break up at all.

The period of open water and pontoon landings in the lakes and rivers decreases to the northward, but the period of solid ice and ski-plane landings increases correspondingly. Aircraft landings on the lakes and rivers must be suspended during the break-up and freeze-up period, which may last anywhere from 3 to 6 weeks. Small lakes on the southern Arctic islands freeze over in mid-September, and ice forms over mainland lakes in October. The thickness of the ice for safe landings depends upon the continuous cold temperatures of the particular winter.

### CHAPTER III

#### SOILS, VEGETATION, AND WILDLIFE

##### SOILS

The close interrelationship of soil, vegetation, and climate is well illustrated in the Arctic. Most of the tundra region has been intensely glaciated, with resulting accumulation of morainic material and rewashed glacial deposits. On the softer and generally flat-lying areas of sedimentary rocks, there is found a finer and usually more calcareous soil, whereas the Shield areas have bare rocky hills with boulder clay and coarse material in the valleys. The low mean annual temperature and the short summer affect soil formation, mostly through poor drainage conditions, and the effect of chemical and biological action in weathering is reduced to a minimum. As a result, vegetable matter does not decompose rapidly, and generally forms a shallow, dark, peaty surface layer, under which lies a water-filled, sticky, often blue-grey layer of mineral soil. Freeze-and-thaw action, significant in a region where summer temperatures often fluctuate about the freezing point, is, next to glaciation, the most important factor in soil formation in the high tundra. The expansion of freezing water causes rock fragmentation, and the heaving and cracking of the soil surface allows some aeration and mixing of the soil elements. Tundra soils are, in general, closely related to bog or marsh soils and show, in some areas, evidence of weak podsolization. Sands and other drier soils may thaw out to greater depths

than the loams and clays and may show a greater development of the soil profile.

"Permafrost" or permanently frozen subsoil, occurs in areas where the winter freezing exceeds the summer thaw. There is generally a layer of topsoil that annually freezes and thaws, and this layer varies in depth from a few inches to several feet. Below this, the permanently frozen ground may extend to a depth of several hundred feet, thus preventing normal drainage below the thin top layer. The depth to which the soil annually freezes and thaws depends on several factors. A layer of muskeg, moss and other vegetable fibres, and the snow cover insulate the soil in summer and winter. Factors of the climate naturally affect freeze and thaw. Exposure to sun and wind, the water content of the soil, and the type of soil and its conductivity are also important.

Various phenomena, peculiar to tundra lands, result from permafrost. Permafrost prevents drainage, and the soil becomes relatively fluid with the arrival of the rapid summer thaw, and tends to creep downhill. This process, called "solifluction", or "soil flow", is hastened along the cut banks of streams and gullies. A striped arrangement of the soil elements, with alternating coarse and fine material, often results from this soil creep, and occasionally small terraces with banks of small stones are found.

Another arctic soil phenomenon is the polygonal soil structure, which may occur on a small scale on fine material, or stony or gravelly material. The polygons may present bare spaces of finer material divided from each other by a network of small stones, often along shallow trenches that are utilized by plant growth. These polygons, though having possibly the same cause as the soil stripes, occur on level ground, and vary from a few inches across to several yards in diameter. Much larger similar polygonal patterns can be observed from aircraft, with mosses and lichens forming the central parts and dwarf willows and other small shrubs forming the outer boundaries. The processes causing these phenomena are not fully understood as yet, though intensive study of permafrost areas and their engineering problems is continuing under the emphasis on the strategic value of the northlands.

In addition to low temperatures and the shortness of the growing season, plant life in the Arctic must contend with drought and the frozen subsoil, and with wind, which increases evaporation and desiccation. However, plants are found in nearly all of the sheltered valleys where there is any soil, and are strongly adapted to their environment. The long period of daylight hours makes up, in part, for the short summer growing season, and the arctic lowlands present a vegetational picture varying from scattered specimens scrambling between rough rock debris to long expanses of prairie, covered with many types of grasses and flowering plants. As in other fields, the collection and identification of hundreds of botanical specimens have been closing, in recent years, some of the gaps in our knowledge of the geographical distribution of plant life.

## VEGETATION

The tree line is not a definite line on the surface of the earth as it appears on the map. Rather, it is a zone in which the weaker species of trees disappear and the hardy ones remain. In this zone, factors of wind, rainfall, and soil confine even the hardy types to the sheltered valleys that finger northward from the main forest. When these trees become smaller and less numerous the tree line merges gradually into the arctic tundra. Even within the Arctic, however, there may be dwarf trees and low bushes spreading out a foot or so above the ground.

The amount of vegetation cover varies locally within the Arctic, depending greatly on soil and exposure. The tundra areas have a variety of plants and grasses, with mosses being very common. In the marshes, cotton grass, sedges, and sometimes sphagnum moss are dominant, with scrub willow along the wet edges. The sandy areas or rocky lower slopes are covered with heaths of lichens and grasses. Small willows, sometimes reaching 5 feet in height but usually measuring only a foot or two, grow in the more favourable sheltered places. The coastal plain west of Hudson Bay, the rolling upland south of Amundsen Gulf, and the lowland of central west Baffin Island are the most extensive regions of tundra vegetation. In these areas lichens are the most important plants as they form the main food supply of the caribou herds that migrate over the region.

Many areas that are simply bare bedrock or dis-integrated rocks and glacial boulders have no surface vegetation cover. This is typical of the mountainous areas, sedimentary plateaux, and the tops of rocky up-land ridges. These barrens have their greatest extent in the interior of northwestern Quebec, to the north of Chesterfield Inlet in Keewatin District, and in the rocky hills of southern Baffin Island. Latitude has less influence upon the distribution of vegetation than the factors of local exposure, drainage, or rock cover. For example, the lowland valleys on the north coast of Ellesmere Island, one of the most northerly land masses in the world, have a good cover of vegetation of several types, and the broader valleys and lowlands on western Ellesmere Island have sufficient vegetation to support wandering herds of musk-oxen.

Few plants edible for humans are raised because limitations of climate and soil virtually prohibit agriculture or gardening. A small vegetable garden has survived in the open at Chesterfield Inlet on soil transported from depressions in the surrounding district. At other Arctic settlements a few leafy vegetables are raised under glass, on soil imported by ship from southern Canada. These "hothouse" gardens are usually limited by the available supply of glass (often storm windows), and the time available for them by the resident white people.

The flora of the Arctic has an economic significance in that it is important to life within the region. All animal food comes ultimately from plants, being either directly assimilated by the larger hoofed mammals and by large and small rodents, or indirectly by all the flesh-eating predators that prey on the herbivorous species. The numbers and distribution of the wildlife population, and, through them, part of the native population, can, therefore, be traced directly to the distribution of plant life. Flora can, therefore, be considered one of the few resources of the Arctic.

## WILDLIFE

Although the Arctic appears to be an uninhabited land, there is a wildlife population that supplies food, clothing, and utensils to the Eskimos. Wildlife is of the utmost importance to the Eskimos as there is no other

local source of food. All hunting and trapping are, therefore, carefully regulated to conserve the supply, especially now that the natives are armed with modern weapons. Hunting for sport is not permitted.

### Land Animals

The Caribou. The most important of the land animals is the barren-ground caribou. Its main range is in the vast tundra on the mainland between Hudson Bay and Great Slave and Great Bear Lakes, and it is estimated that more than 600,000 caribou roam over this area. They migrate northward from the forested parts of northern Manitoba and Saskatchewan in April and May. Scattered columns may be several miles wide, and contain several thousand animals. Fawns are born on the tundra. The migrations southward begin in August and reach the shelter of the forested winter ranges by December. Some herds remain in the Arctic throughout the winter, pawing through the shallow snow cover to feed.

The only other sizable herds are found on western Baffin Island, with perhaps as many as 5,000 ranging widely, in small herds, over the lowlands. Only rarely did the Eskimos of the rugged south and east coasts obtain caribou. When it became apparent that Eskimos moving south from Igloolik and north from Cape Dorset were depleting the herds by increased and more effective hunting, the season was closed. There are also caribou herds in northern Yukon Territory.

The number of caribou in Arctic Quebec decreased rapidly early in the present century, and the animals are no longer in sufficient numbers to provide food and clothing for the Eskimos. Forest fires have destroyed some of the winter range, but as other areas of abundant summer and winter range exist uncropped, it is likely that overhunting is the chief reason for the decline.

Polar caribou, a smaller species of white colouring, exist on the lowlands of some of the Northern Arctic islands wherever there is vegetation, and on the northern parts of the Western Arctic islands. As no Eskimos live in these areas, their increase is controlled by other factors.

Caribou are hunted by the natives for both food and clothing, and the skins, when taken during late

summer, can be made into the best winter clothing available in the north. Several hundred Eskimos dwelling in central Keewatin District and northeastern Mackenzie District live chiefly on caribou meat, supplementing this diet with fish from the numerous lakes. To the Eskimos of Baffin Island and Arctic Quebec caribou have become of small importance compared to sea mammals.

The Arctic, or White Fox. The white fox is at times an animal of great economic importance in the Arctic. The trapping of white foxes, along with the occasional blue fox, has induced many Eskimos to change from a migratory people hunting for food to a race of trappers. The fox is of negligible importance as food for the Eskimos, and its fur cannot compare with that of caribou or bear for durability. Its ornamental quality has been desired by the outside world, however, and traders furnished the natives with ammunition, guns, utensils, and supplies in exchange for furs. The Arctic fox is a scavenger, which lives partly on the remains of sea life that other animals kill along the coasts, but its chief prey is the lemming-- a small rodent that lives in northern areas. There is a periodic 3- to 5- year fluctuation in the scarcity and abundance of foxes, which correlates with a similar fluctuation in the numbers of lemmings.

The Polar Bear is of some local importance and is killed by Eskimos whenever possible. It has a wide distribution throughout the Arctic islands, but is seldom seen on the mainland. The meat is used chiefly for dog feed, but is eaten occasionally by the Eskimos. The fur is used chiefly for bedding and robes, but also for putting an ice layer on sled runners.

The Musk-ox. This is a greatly reduced species and the remaining few thousand musk-oxen are protected by the government. Not even the Eskimos are allowed to kill them, except in dire necessity. The few hundred head in the Thelon Game Sanctuary and vicinity are the southwesternmost large group on the mainland of Canada. Limited numbers of musk-oxen roam on the lowlands of the far northern islands. In particular, they have been reported in small herds on western Ellesmere Island, northern Devon Island, eastern Melville Island, and Prince Patrick Island.

## Sea Mammals

Walrus, seals, and white whales are the most important of the sea mammals. All serve as food, and in the case of seals also as clothing for the native population.

Walrus. The Atlantic walrus are no longer widespread throughout the Canadian Arctic and are now hunted chiefly off southeastern Baffin Island, in Hudson Strait, northern Hudson Bay, and Foxe Basin. They are also known in Lancaster Sound and off the east coast of Devon and Ellesmere Islands. No walrus are obtained in the Western Arctic, where the enclosed seas freeze over completely. Walrus are usually killed in late summer when they congregate on islands off the coasts. They are also hunted in the autumn from the newly formed sea ice. Organized hunts are supervised in several places by the Royal Canadian Mounted Police or officials of the Hudson's Bay Company, to see that the animals are not slaughtered needlessly. Unless Eskimos are hungry they usually prefer other meat to that of walrus, but they use both the hide and the meat for dog feed. The hide is often used for bed robes. There is a small but growing demand for carved ivory objects made from the tusks of walrus. This handicraft is a spare-time activity, and the Eskimos are discouraged from killing walrus simply for their tusks.

Seals. Seal meat is the staple diet of most of the Arctic Coast Eskimos. Several species of seal are to be found throughout arctic waters, but the two most numerous kinds along the coasts are the small ringed, or jar seal and the larger bearded or "square flipper" seal. Seals feed mainly on various small fishes and plankton, and are found along all the coasts and fiords. Many Eskimo groups subsist for months at a time on the meat and blubber of the ringed seal. The de-haired skin of the ringed seal is used for the manufacture of waterproof boots and kayak covers, and the haired skin is made into clothing to supplement a reduced supply of caribou clothing. The blubber is the chief source of oil for the small Eskimo cooking and heating lamps. The "white coats" of baby seals, and, to a lesser extent, skins of adult seals, are purchased by traders, but the chief use of the animal in the Canadian Arctic is that made directly by the local Eskimo inhabitants.

Formerly, seals were caught by harpooning, but now most of them are first shot either in the water or while sunning themselves on the ice near breathing holes, and then harpooned. Unfortunately, many seals sink immediately if shot, especially in early summer when they are not fat. Seal nets are used in many districts and are placed in the open water where ice has been prevented by tidal action from forming. Ingenious seal hooks have been used successfully in breathing holes in the Western Arctic.

The bearded seal is larger than the jar seal and may weigh as much as 800 pounds. It is valued by the Eskimos as it provides a large amount of meat and blubber. The heavy hide is used for boot soles or is cut up into heavy line, which is used for dog harness, harpoon lines, or strong lashings of any kind. Bearded seals are less numerous than jar seals and do not travel in large herds, but they are usually plentiful enough for local needs.

The harp or Greenland seal is occasionally found off the north and east coasts of Baffin Island and in Hudson Strait, but is more common off the coasts of Labrador and Newfoundland. Commercial sealing for the other species of seals is not permitted in the Arctic for it would certainly decrease the food supply of the Eskimos.

Whales. The whaling industry of the last century brought Eskimos into close contact with white men when they assisted the whalers in their hunts. At one time, whalebone houses were used by Eskimos, but these are now only found as ancient ruins of a past culture. As the large Greenland whales have almost been exterminated, the natives are able to hunt only the small white whales and narwhal in certain local areas. As the season on Greenland whales has been closed for some time, they are again being reported occasionally, and can be killed for food by Eskimos. White whales, about 12 to 15 feet in length, are found in several Arctic seas. They can be hunted without licence by Eskimos and the R.C.M.P. in the bays or fiords, which they enter in large schools. They are either shot and harpooned, or caught in large nets. White whales are fairly common in Hudson Bay, Hudson Strait, along the eastern coasts of Baffin Island, and off the mouth of Mackenzie River. At one time, oil

was rendered down after an annual whale hunt conducted by the Hudson's Bay Company at the head of Cumberland Sound, and several hundred barrels of whale oil were exported each year. A similar industry, using the meat, hide, and blubber for a variety of purposes started at Churchill, Manitoba, after World War II.

Eskimos use its skin and meat for dog feed and for food to supplement their diet of seal. The blubber is used chiefly as oil for their lamps.

Narwhal are known in the waters adjoining northern Baffin Island, and along the coasts surrounding Baffin Bay. They have also been noted occasionally in early summer in Hudson Strait and Foxe Basin. The flesh and skin of the narwhal are used in the same way as those of the white whale, but special hunts for this animal are seldom made. The long, spirally twisted horn that projects forward from its mouth sometimes measures over 8 feet, and weighs over 15 pounds. The tusk has value as ivory and is traded by the natives.

### Fish

Fish life in the Arctic is not varied. Arctic char is the most common food fish. Although important to a more complete diet, fish play a lesser part in the food supply of the Eastern Arctic Eskimos than in that of the natives of the Western Arctic. Eskimos catch char during the spring migration of the fish down the rivers to the sea, and in the autumn run up the rivers. During early or late winter they fish through the ice of the interior lakes.

Fish nets are used rather inexpertly by the natives of Hudson Bay and Hudson Strait. Stone dams and spears are still in use in northern Baffin Island and in the Central Arctic. Although fish appear to be abundant locally, continuous fishing has decreased their numbers in some rivers because of the slow rate of growth in northern waters. Eskimos recognize this fact by rotating fishing camps from year to year. Commercial fishing has not developed in the Canadian Arctic because the large area of Hudson Bay does not contain fish food in quantity, and the commercial fish, chiefly cod, of the Newfoundland and Labrador coasts only penetrate Hudson Strait as far as Ungava Bay. Investigations indicate, however, that an Eskimo fishery for cod is possible in Ungava Bay using methods developed by the Greenlanders.

## Wildfowl

In addition to the life on land and in the sea, the Arctic is the nesting ground for many species of wild-fowl, and almost one hundred kinds of birds have been noted but many of these are rare there. Among the more common ones are ptarmigan, loons, cranes, plovers, sand-pipers, jaegers, gulls, murre, guillemots, owls, and several species of song-birds. Eskimos eat large numbers of ptarmigan, but they do not depend on bird life to any great extent in normal times. They may gather birds' eggs in the spring, and the natives of the Belcher Islands have been known to make clothing from bird skins, but in general the bird life of the Arctic is of economic importance chiefly as a reserve food supply in times of stress.

## CHAPTER IV

### EXPLORATION AND HISTORICAL DEVELOPMENT

The geographical arrangement of the bays and islands of the Canadian Arctic coupled with the difficulties of navigation in polar waters greatly impeded the progress of exploration. The primary and lasting goal in the early exploratory period was the finding of the Northwest Passage, thought to be an easy route to the Orient. When the Franklin expedition of 1845 failed to return, the ensuing search gave another powerful impetus to exploration. The Arctic opened up in the late 19th century when commercial interests discovered a rich source of wealth in furs and whale oil. Since 1920, the establishment of permanent posts and the use of aircraft and powerful icebreaking vessels have immensely increased our knowledge of the geography of the Canadian Arctic.

#### EARLY EXPLORATION 1576-1848

The region was unknown to Europeans, except for vague Norse reports, prior to the voyages of Martin Frobisher in 1576-8 and those of John Davis in 1585-7. These voyages outlined the east coast of Baffin Island and showed that a land mass blocked any possible route of a Northwest Passage through this area. Further exploration, lasting over 350 years, gradually brought back information of the region west of the forbidding barrier of Baffin Island and Labrador.

Exploration in the 17th century was concerned chiefly with finding a passage through the region rather than investigating the area itself. Henry Hudson's last voyage of 1610-11 indicated a huge sea west of Hudson Strait. Explorations by Button, Bylot, and Baffin between 1612 and 1615, however, showed that a land mass blocked the western side of the inland sea, and ice floes impeded their progress into the opening to the north. Further voyages by Foxe and James in 1631 only confirmed the land-locked character of the Bay and the problems of ice navigation.

Following the formation of the Hudson's Bay Company in 1670, ships laden with furs found the secret of successful navigation of Hudson Bay and Strait in August and September. Year after year, tiny ships entered the bay, but their interest was in the wooded areas to the south rather than the treeless Arctic to the west and north.

A short flurry of exploration occurred in 1742, aimed at penetrating northwest of Hudson Bay. Voyages were backed by English merchants who wished to offer competition to the prosperous Hudson's Bay Company. Middleton's expedition of that year did not proceed beyond Repulse Bay, and later voyages only resulted in finding land at the heads of Wager Bay, in 1747, and Chesterfield Inlet, in 1762. Finally, Samuel Hearne's epic wanderings along the edge of the tree line took him in 1770-72 from the Hudson's Bay Company fort at Churchill to the mouth of Coppermine River. His accounts and maps indicated the great size of the Arctic mainland, and were the first reports about the Western Arctic.

In the 19th century, exploration turned to the openings in the coast north and west of Baffin Bay. The first voyage of Edward Parry in 1819 took him westward in Lancaster Sound, exploring a broad channel as far as Melville Island. There he was stopped by heavy, eastward-moving ice floes, and was forced to winter at Winter Harbour, Melville Island. In the following summer, ice again stopped his progress in M'Clure Strait, and he returned to England, reporting that a further passage in that direction was impossible. Parry's next two voyages tried different routes through the Arctic islands, but they also failed. In 1821, his ships reached Igloolik at the north end of Foxe Basin, but he found Fury and Hecla Strait jammed with ice. Parry spent two

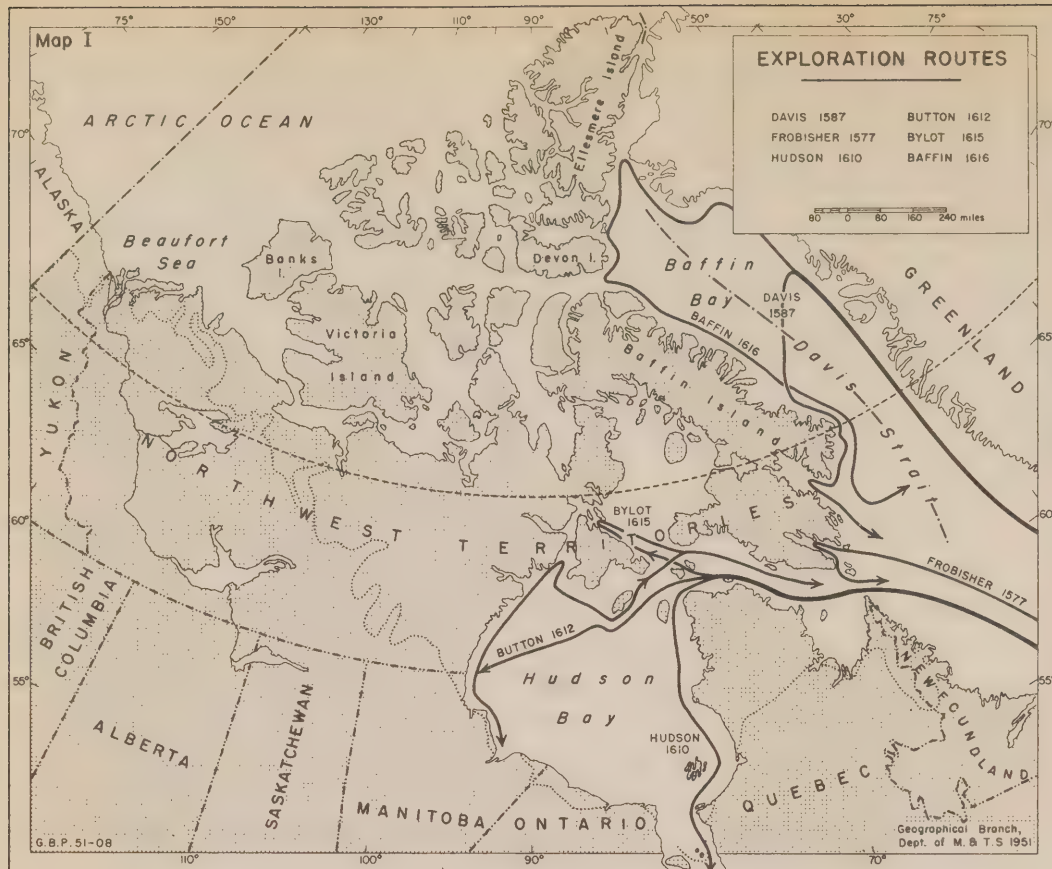


Figure 7. Exploration routes - Map I.

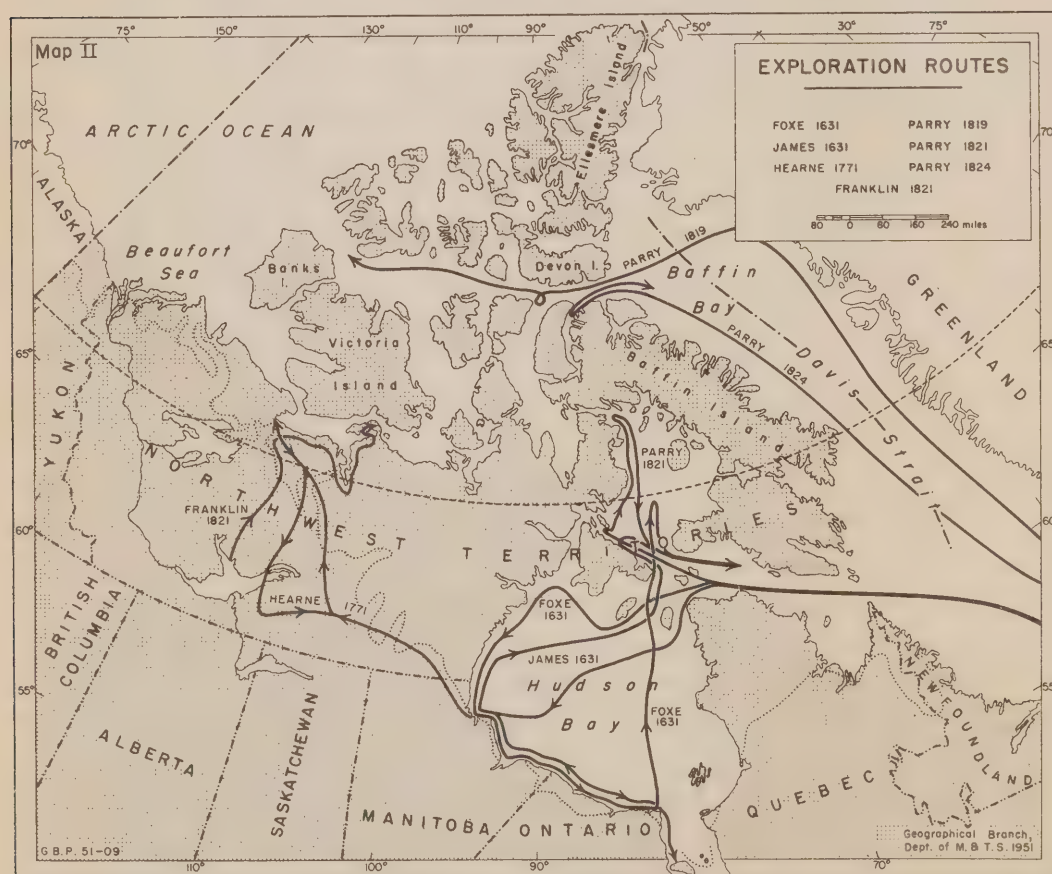


Figure 8. Exploration routes - Map II.

winters there, but was unable to pass through the strait. In 1824, a voyage southward in Prince Regent Inlet ended when one of his small ships was wrecked on eastern Somerset Island.

In the meantime, John Franklin and a party of British Naval officers were exploring the Western Arctic coastline. They descended Coppermine River in 1821 and mapped the coast as far east as Kent Peninsula. Their straggling, starving return over the uninhabited tundra from Bathurst Inlet to the head of Snare River is one of the great tales of arctic privation. Franklin's second expedition of 1825-27 split into two parties, which explored the coast east and west of the Mackenzie River delta. The party under John Richardson completed the mapping of the Arctic coast between the Mackenzie delta and Coppermine River. Franklin's western party mapped much of the northern Alaskan coast, but failed to reach Point Barrow.

John Ross continued the exploration of the Arctic channels from the east in 1829. He wintered his ship on the east side of Boothia Peninsula and his nephew made several sledge trips into the surrounding rugged country mapping the western side of the peninsula and visiting the approximate site of the North Magnetic Pole. Ross was able to move his ship only 3 miles through the ice during the summer of 1830. When the ice still remained fast about the vessel in the following summer it was abandoned. The discouraged party moved northward in small boats, but when stopped by ice, spent a fourth winter at Fury Beach on Somerset Island. They were finally rescued the next winter by a whaling vessel in Lancaster Sound.

The next crossing of the Arctic mainland was made by George Back in 1834. From Fort Reliance, at the eastern end of Great Slave Lake, he explored northeastward down the river that now bears his name, hoping to reach the missing John Ross expedition. At Chantrey Inlet he was stopped by ice floes and had to turn back.

The remainder of the Western Arctic coastline was mapped by Thomas Simpson in 1837-39. In the first year, he travelled westward by small boat along the Alaskan coast, reaching Point Barrow, which had previously been mapped from Bering Sea. In 1839 he was able to traverse the unknown area between Kent Peninsula and Chantrey Inlet, and on the return touched the south coasts of King William and Victoria Islands.

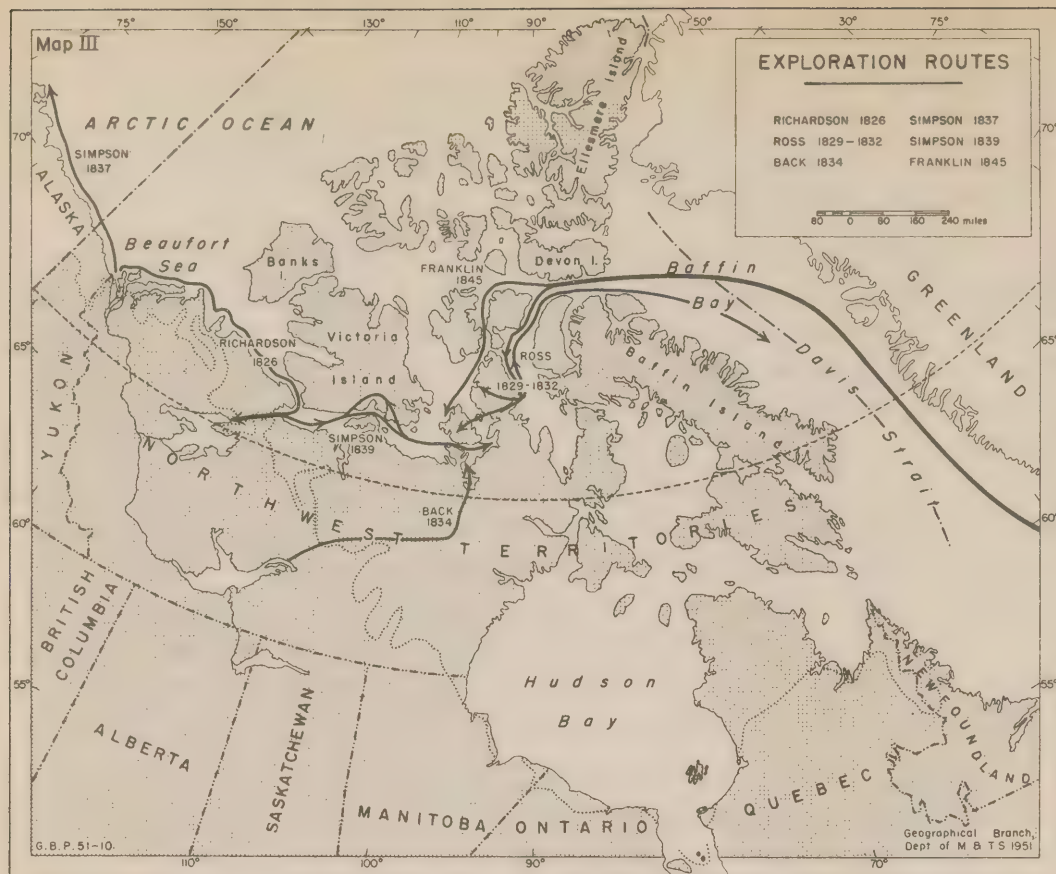


Figure 9. Exploration routes - Map III.

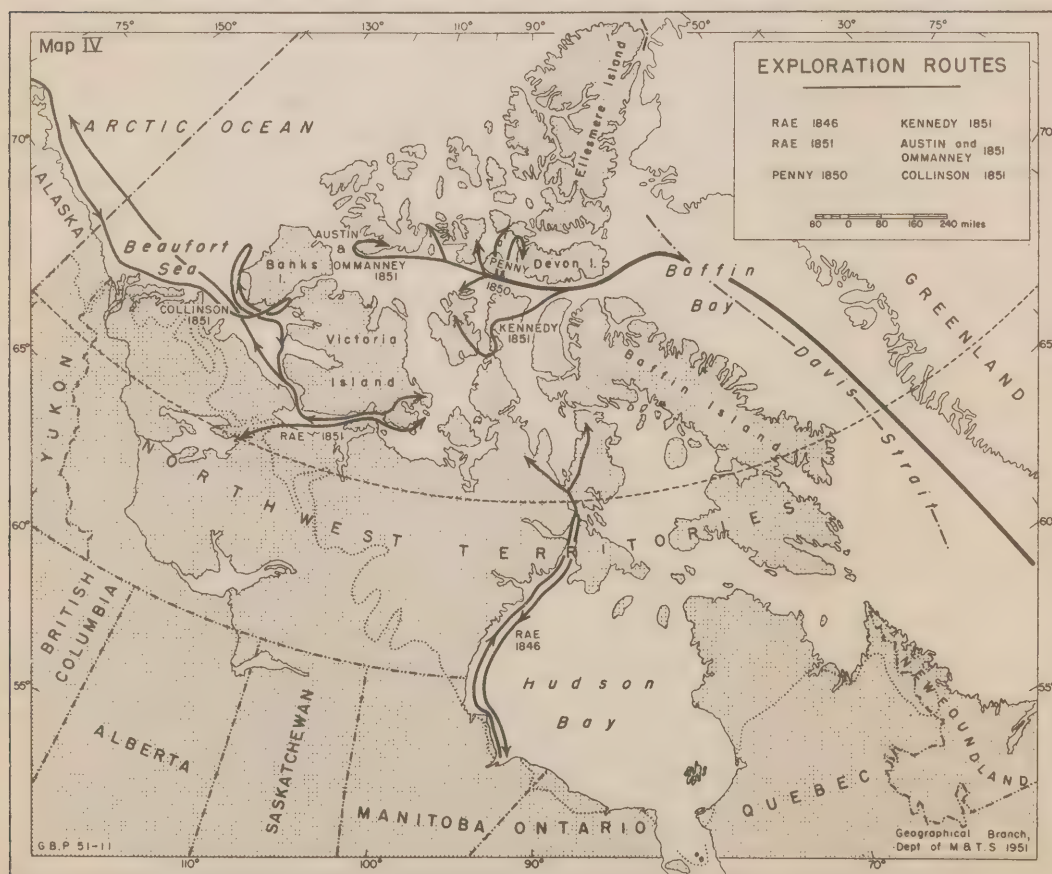


Figure 10. Exploration routes - Map IV.

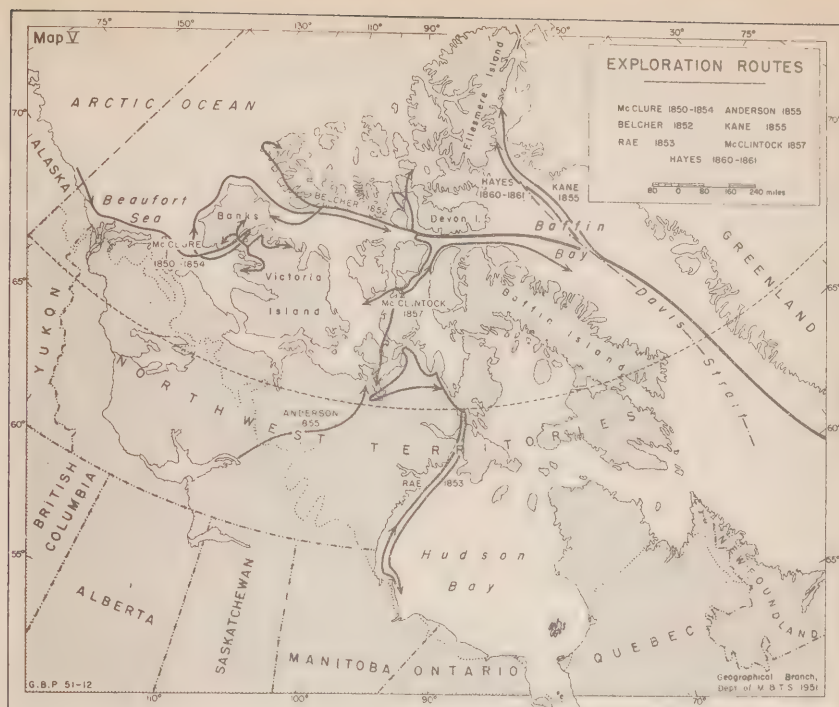


Figure 11. Exploration routes - Map V.

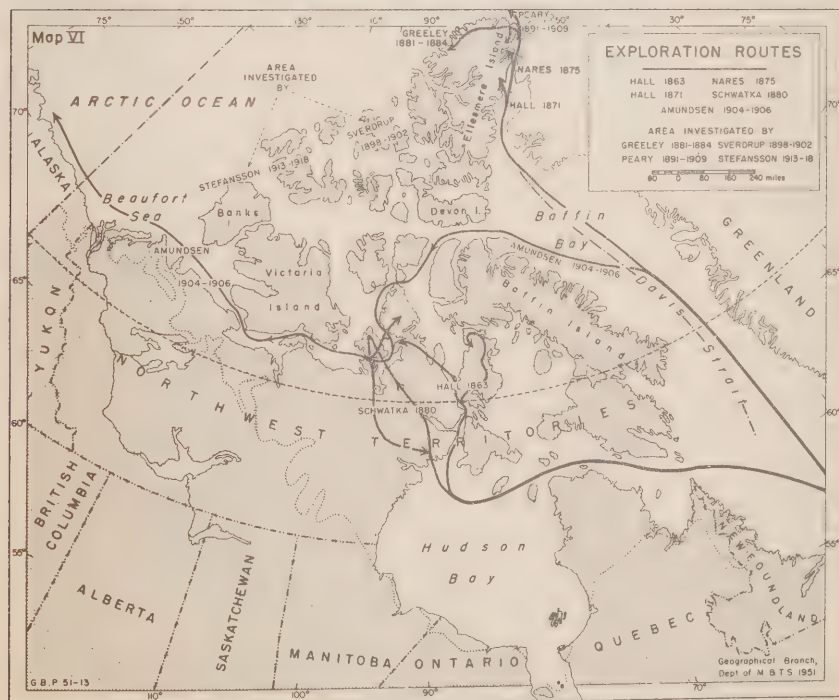


Figure 12. Exploration routes - Map VI.

## THE SEARCH FOR FRANKLIN 1845-1880

No further major exploration into the formidable Arctic was attempted until John Franklin's tragic voyage. The mysterious loss of this British Naval Expedition south of Barrow Strait in 1845 was to accomplish more than any other single event in opening up the Arctic. With the British Government largely financing the search, the region was scoured for traces of lost vessels or men. Well-organized search parties, amounting to some forty expeditions within the next decade, many equipped to remain in the Arctic for several years, sailed and sledged thousands of miles during this epic quest. The United States joined the search, thus creating an American interest in the Arctic. This interest soon turned towards the attainment of the Pole.

British expeditions under Penny, Austin, Ommaney, and Kennedy in 1851, and Belcher in 1852, entered the region along the established route and explored the channels off Lancaster Sound. M'Clure and Collinson were sent in 1850 to attempt the western route, and though they missed finding the lost party, M'Clure became the first leader to navigate the Northwest Passage. After being hopelessly ice-bound off eastern and northern Banks Island for 3 years, M'Clure and his men crossed the ice on foot to Melville Island in 1853. Next spring they sledged eastward to Beechy Island, and were carried from there by ship to England.

Rae made three trips by land, in 1846, 1851, and 1853, and on his last trip was successful in finding traces of the Franklin party in Chantrey Inlet. Anderson in 1855 corroborated Rae's findings on another trip to the same area. M'Clintock, one of the era's most remarkable explorers, in 1857-58 finally ascertained the fate of the Franklin expedition, explored King William Island, and discovered the most feasible route to the west. Two Americans, Hall (1863) and Sckwatka (1880), investigated Melville Peninsula and King William Island in search for further Franklin records, but added little to the findings of M'Clintock.

The geographical information concerning land masses, ice conditions, climate, and living conditions that resulted from the Franklin search expeditions,

brought the realization that there probably was no practical route through the Arctic islands. The development of new trade routes in other parts of the world relegated the Northwest Passage to a position of little economic importance, and the explorations that accompanied the search for a passage indicated that there were few resources to attract development.

#### FROM EXPLORATION TO EXPLOITATION 1880 onwards

Further impetus to exploration of the Arctic came from three major sources; the whaling industry, attempts to reach the North Pole, and, finally, the efforts of the Canadian Government in administering the Arctic lands acquired from Britain.

The whaling industry shifted from the Greenland Sea to Baffin Bay during the early part of the 19th century. For almost 100 years, whaling vessels were to be found somewhere within the region. In the latter part of the century, Scottish whalers were spending the summer seasons hunting in Baffin Bay, and some of them wintered on the east coast of Baffin Island. New England whalers worked in Hudson Bay and wintered there in order to start hunting early in the following season. Many of the inlets and harbours of Baffin and Hudson Bays were explored by the whaling fleet, and their winter experiences taught white men how to live in the Arctic region. The whalers shifted to the Western Arctic at the end of the century, reaching Herschel Island in 1890. From that base, and from Baillie Island, they hunted in Beaufort Sea. Many of the whalers wintered in the area, and began the first trading with the Eskimos.

After 1860, the largest remaining unexplored part of the Arctic lay north and west of Baffin Bay. The chief, unknown areas to the south were western Baffin Island and northeastern Victoria Island. Successive expeditions from Britain and the United States pushed farther and farther north in attempts to outline the land masses and explore towards the North Pole. The northern coast of Ellesmere Island was mapped by Nares' expedition in 1875, and other important explorations were carried out by Hall (1871) and Greely (1881). The race for the Pole ended with Peary's well-planned dash in 1909, after several unsuccessful attempts to penetrate into the Polar Pack by sledge. In the meantime

the Norwegian expedition of Sverdrup (1898-1902) had found and mapped several new islands, including Axel Heiberg and the Ringnes group, in the area west of Ellesmere Island. The map of the far northern Arctic islands was finally completed north of Melville Island with the explorations of the Canadian Arctic Expedition under V. Stefansson (1913-18). Stefansson and his party did a great deal of difficult travelling, living off the native game of the region for much of the time. They brought back more accurate descriptions and maps of the already known areas, and, in addition, discovered Borden, Brock, and Meighen Islands.

After the Arctic islands were legally transferred to Canada by Britain, the Canadian Government sent scientific expeditions into the Arctic that brought back factual information concerning the geography and resources of the region.

In 1884, the first of these expeditions entered the Eastern Arctic region in the D.G.S. *Neptune*, captained by A. R. Gordon, with Dr. R. Bell in charge of the scientific party. In 1885-86, the expedition was carried by the *Alert*. The possibilities of the Hudson Strait navigation route were investigated, and studies were made of the Eskimo inhabitants; the fauna, and the geology of the area. In addition, meteorological stations, where observers spent the winter, were established in Hudson Strait. In 1897, the *Diana*, under Commander Wakeham, investigated earlier and later dates for navigation. Ice conditions were again studied, and data gathered on coastal geology and marine life in Hudson Strait.

Between 1576 and 1902 there were sixty-two British expeditions, ten American, one Danish, one Norwegian, one German, and three Canadian expeditions to the Canadian Arctic, but between 1902 and 1918 seven Canadian expeditions were made to the region. This increase in Canadian exploratory activity began in 1903 with the voyage of the *Neptune* commanded by A. P. Low. The party wintered north of Chesterfield, in Hudson Bay, and the next summer visited Ellesmere and Devon Islands in the far north. A voyage in 1904 under Captain J. E. Bernier in the C.G.S. *Arctic* established a police post at Cape Fullerton, northeast of Chesterfield. At the same time a police detachment was placed at Herschel Island in the

Western Arctic. In 1906, a series of wintering expeditions was continued in the historic *Arctic* under Captain Bernier. Winters were spent at Albert Harbour, near Pond Inlet (1906-07); Winter Harbour, Melville Island (1908-09); and at Arctic Bay, northern Baffin Island (1910-11). The organized information gathered on these voyages was made available to the public through a series of government publications.

Although trading had been carried on by most whalers, the first permanent trading post in the Eastern Arctic was opened in 1909 at Wolstenholme, northwestern Quebec, by the Hudson's Bay Company. Within the next few years other posts were opened on both sides of Hudson Strait and along the west coast of Hudson Bay. In the Western Arctic there was an independent trader at Bernard Harbour in 1911, and other traders had small posts along the Coronation Gulf coast by 1920.

After 1920, white settlement began to spread northward into the Arctic, and it is from this date that most of the present arctic settlements were established. This in turn led to an extension of police, educational, and health facilities and, in the course of maintaining these facilities, scientific information was gathered and is still being gathered by the various government officials and special investigators on their journeys to the North.

In addition, special scientific expeditions are made to the region, but in recent years they have been too frequent to enumerate.

#### AN ANNOTATED CHRONOLOGY OF EXPLORATION

1004 - KARLSEFNI. According to old Norse records, Vikings are believed to have landed on Baffin Island previous to Lief Eriksson's discovery farther south.

1500-01 - CORTEREALS. This Portuguese explorer may have reached as far north as Cape Chidley in northern Labrador.

1576-78 - FROBISHER. Made three voyages to Frobisher Bay, Baffin Island, while seeking Northwest Passage, and returned with gold ore of little value.

- 1585-87 - DAVIS. In three voyages, penetrated Davis Strait, discovered Cumberland Sound on Baffin Island, and sailed along the north Labrador coast.
- 1602 - WEYMOUTH. Supposedly reached 69 degrees latitude in Davis Strait and entered Hudson Strait.
- 1610-11 - HUDSON. Discovered Hudson Bay and wintered in James Bay. Set adrift by mutineers who brought ship back to England.
- 1612-13 - BUTTON. Reached west coast of Hudson Bay and entered Roes Welcome Sound.
- 1615 - BYLOT. Discovered islands in Hudson Strait, and landed on Southampton Island.
- 1616 - BAFFIN. Discovered Baffin Bay, Smith Sound, and entered Jones and Lancaster Sounds.
- 1619-20 - MUNCK. A Danish expedition that spent a desperate winter at the mouth of Churchill River, Hudson Bay.
- 1631 - FOXE. Explored the west coast of Hudson Bay and entered Foxe Strait.
- 1631-32 - JAMES. Spent a miserable winter in James Bay.
- 1668-69 - GILLMAN and GROSEILLEURS. The first successful fur traders in Hudson Bay, they wintered at Fort Charles at the mouth of Rupert River in James Bay.
- 1719-21 - KNIGHT. The Hudson's Bay Company expedition perished at Marble Island on the west coast of Hudson Bay.
- 1741-42 - MIDDLETON. Wintered at Churchill and discovered Wager Bay and Repulse Bay, proving that no western route existed there.
- 1746-47 - MOORE. Explored Wager Bay.
- 1761-62 - CHRISTOPHER. In two voyages, explored Chesterfield Inlet to the mouth of Thelon River.
- 1769-72 - HEARNE. Travelled overland with Indians from Churchill to the mouth of Coppermine River, being the first white man to reach the western Arctic Ocean.

- 1789 - MACKENZIE. Explored the Mackenzie River system from Lake Athabaska to the Arctic Ocean.
- 1792-93 - DUNCAN. Explored parts of the west coast of Hudson Bay, and travelled some 30 miles up Thelon River for the Hudson's Bay Company.
- 1818 - ROSS. Explored shores of Baffin Bay and entered Lancaster Sound.
- 1819-20 - PARRY. Penetrated Lancaster Sound, Barrow Strait, and wintered at Winter Harbour on Melville Island.
- 1819-22 - FRANKLIN. This expedition travelled overland from Great Slave Lake to Coronation Gulf, discovering much new territory.
- 1821-23 - PARRY. Entered Foxe Basin, Repulse Bay, and examined the east coast of Melville Peninsula to Fury and Hecla Strait.
- 1824 - LYON. An unsuccessful attempt to explore the Repulse Bay region.
- 1824-25 - PARRY. Reached Somerset Island through Lancaster Sound and Prince Regent Inlet.
- 1825-27 - FRANKLIN. Travelling down Mackenzie River, the party split and explored along the Arctic coasts west to 145°52' west longitude, and east to Coppermine River.
- 1829-33 - ROSS. Reached Lord Mayor Bay, Boothia Peninsula, through Prince Regent Inlet, and visited Magnetic Pole. The expedition spent four winters in the Arctic.
- 1833-35 - BACK. Descended Back River to Montreal Island at its mouth.
- 1836-37 - BACK. An unsuccessful attempt to explore the Melville Peninsula area.
- 1837-39 - SIMPSON and DEASE. These Hudson's Bay Company officers mapped much of the Arctic coastline, reached Point Barrow, Alaska, from the Mackenzie delta, and explored eastwards from Coppermine to Boothia Peninsula.

- 1845-48 - FRANKLIN. This large expedition passed through Lancaster Sound, Prince Regent Inlet, and Franklin Strait and the ships were wrecked off the north-west coast of King William Island. The attempt to reach help failed and there were no survivors.
- 1846-47 - RAE. Explored the Melville Peninsula and Boothia Peninsula areas for the Hudson's Bay Company.
- 1847-49 - RICHARDSON and RAE. Searched the shorelines of Amundsen Gulf and Coronation Gulf.
- 1848-49 - ROSS. Wintered on Somerset Island and sledge parties explored the Barrow Strait region.
- 1849-50 - SAUNDERS. This resupply mission was able to penetrate Lancaster Sound only as far as Navy Board Inlet.
- 1849-50 - PULLEN. Travelled around Alaska to the Mackenzie delta and as far east as Cape Bathurst.
- 1850-51 - AUSTIN and OMMANEY. This large expedition wintered in Barrow Strait and made many sledge journeys, some as far west as M'Clure Strait.
- 1850-51 - PENNY. Explored channels leading off Barrow Strait.
- 1850-51 - DeHAVEN and KANE. The first United States expedition to the Arctic; added very little to the knowledge of the Barrow Strait area where they wintered.
- 1850-51 - ROSS. Explored part of Cornwallis Island.
- 1850 - FORSYTH. Reached Somerset Island, but accomplished very little.
- 1850-55 - COLLINSON. Entered Western Arctic around Alaska, wintered at Walker Bay and Cambridge Bay, Victoria Island, and on the Alaska coast. Investigated Prince of Wales Strait, the west coast of Banks Island, the Coronation Gulf area, and the west side of Victoria Strait.
- 1850-54 - M'CLURE. Rounding Alaska, M'Clure's ship almost circumnavigated Banks Island. After exploration by sledge journeys, the crew was rescued

by Belcher's expedition when Kellett found M'Clure's note at Winter Harbour. M'Clure returned with Belcher, therefore, successfully completing the passage.

1850-51 - RAE. Explored southern Victoria Island.

1851-52 - KENNEDY. Discovered the existence of Bellot Strait and explored Prince of Wales Island.

1852 - INGLEFIELD. Penetrated Smith Sound and Jones Sound, and visited Beechey Island.

1852-54 - BELCHER. The last Admiralty search for Franklin, this large expedition of four ships continued sledge explorations in islands north of Barrow Strait and Melville Sound. Rescued M'Clure and crew, but abandoned all vessels and returned on Pullen's ship.

1852-54 - PULLEN. Little exploration, as this party was a base vessel at Beechey Island for Belcher's expedition.

1853-54 - RAE. Under orders from the Hudson's Bay company, he sledged from Repulse Bay to the west coast of Boothia Peninsula, obtained news from natives of the Franklin expedition, and returned with relics.

1853-55 - KANE and HAYES. A private United States expedition that explored the passages between Ellesmere Island and Greenland almost as far as Kennedy Channel.

1855 - ANDERSON. An officer of the Hudson's Bay Company, he traversed Back River to Montreal Island.

1857-59 - M'CLINTOCK. Amazing sledge journeys from Bellot Strait to King William and Prince of Wales Islands resulted in certain information about the Franklin disaster, to which little has been added since.

1860-61 - HAYES. United States expedition, the first in that country's attempts to reach the pole, sledged up Ellesmere Island to beyond the 80 degree parallel.

- 1860-62 - HALL. United States expedition that wintered for 2 years in Frobisher Bay.
- 1864-69 - HALL. Explored parts of Melville Peninsula from Repulse Bay.
- 1871-73 - HALL. Backed by the United States government, this expedition reached  $82^{\circ}11'$  along the east coast of Ellesmere Island.
- 1875-76 - NARES. British Admiralty attempt to reach the Pole resulted in exploration of parts of northern Ellesmere Island and Greenland, and a journey out on the polar ice to  $83^{\circ}20'$ .
- 1875-76 - YOUNG. Two voyages by Young produced few results. The attempt at the Northwest Passage was blocked by ice in Peel Sound and his second trip was spent near Smith Sound hoping to contact the Nares expedition.
- 1878-80 - SCHWATKA. An American, Schwatka, explored King William Island, where Franklin relics were found, and returned via Chesterfield Inlet to Hudson Bay.
- 1881-84 - GREELY. Established meteorological station on Ellesmere Island and explored much of north Ellesmere.
- 1883-84 - BOAS. Explored Cumberland Gulf, Baffin Island, and parts of the interior of the island.
- 1884-85-86 - GORDON. Canadian expeditions to study navigation conditions in Hudson Strait and Bay.
- 1893 - TYRRELL Brothers. Canadian expedition explored interior Keewatin.
- 1894 - TYRRELL. Continued exploration of interior of Keewatin.
- 1897 - WAKEHAM. Canadian expedition to study navigation conditions of Hudson Strait and examine geology of coastlines.
- 1898-02 - SVERDRUP. A private Norwegian expedition that added major discoveries in the northern Arctic islands.

- 1898-02 - PEARY. An American expedition that explored north Greenland and Ellesmere Island and reached 84°17' on the Arctic ice pack.
- 1903-04 - LOW. Canadian Government expedition that visited Baffin Island, the west coast of Hudson Bay, and Lancaster Sound.
- 1905-06 - PEARY. Attempted to reach the Pole, failed, but attained 87°06' and explored Axel Heiberg and north Ellesmere Islands.
- 1906-07 - BERNIER. Canadian expedition that visited islands through Lancaster Sound, Barrow Strait, and Melville Sound.
- 1907-09 - COOK. Explored northern Sverdrup Islands and claimed to have reached the Pole.
- 1908-09 - PEARY. From north Ellesmere Island, finally succeeded in reaching the North Pole.
- 1908-12 - STEFANSSON and ANDERSON. From Mackenzie delta, explored coasts from Point Barrow, Alaska, to Coronation Gulf.
- 1908-09 - BERNIER. Canadian expedition that wintered at Winter Harbour on Melville Island and made sledge journeys to Banks Island.
- 1909-11 - HANTZSCH. Private expedition on which parts of Baffin Island were mapped and an ornithological study made of the Foxe Basin coast.
- 1910-11 - BERNIER. Canadian expedition to Melville Sound, with sledge journeys to Fury and Hecla Strait and N.W. Baffin Island.
- 1911-12 - DOUGLAS. Overland trip to Coppermine River area.
- 1912-13 - BERNIER. Trip to Pond Inlet from which A. Tremblay sledged across Baffin Island to Igloolik.
- 1913-17 - MACMILLAN. American expedition that explored the Sverdrup Islands and Ellesmere Island.
- 1913-18 - STEFANSSON. Canadian Government expedition that made scientific studies of the western Arctic mainland and islands. Borden, Meighen, and

Lougheed Islands discovered by Stefansson during his famous self-supporting sledge journeys on the sea ice and islands.

## CHAPTER V

### WHITE POPULATION AND SETTLEMENTS

#### POPULATION

Although the Arctic contains all of the Canadian Eskimo population, yet it has only a thinly scattered white population. The environment of the region is such that the usual occupations that are possible in other parts of Canada cannot be carried on in the Arctic; factors of topography, climate, and resources place restraints upon development. Man must either adapt himself to these restrictions, or become familiar with them in order to overcome them. In the Arctic, a knowledge and understanding of the physical nature of the area are basic in explaining the distribution and activities of the population.

Few of the white people living in the Arctic can be classed as permanent residents. Some of the missionaries and traders have spent up to 10 or 15 years in the region, but in general most of the people spend 1 year or 2 years in the Arctic and are then posted to more southerly stations. During recent years, the number of white residents spending the full year in the Arctic has been increasing, and now totals about eight hundred.

There are few occupations open to white persons apart from those associated with the organizations operating in the Arctic. The residents are, for the most part, either traders, missionaries, or Government officials - which include doctors, nurses, welfare teachers,

policemen, meteorologists, and radio operators. There have been a few white trappers operating in southern Keewatin District and the lower Mackenzie area, but apart from trapping the Arctic offers little economic opportunity for the individual.

During the winter, the police, missionaries, and sometimes traders visit Eskimo camps in the local area, and these trips, made by dog-team over rough terrain or pressure ridges of sea-ice, require a hardy type of man. Living conditions, however, are improving and are now fairly comfortable for white residents.

### SETTLEMENTS

The word "settlement" is perhaps misleading as many of the places which appear on the map of the Arctic are no more than a cluster of buildings around a fur-trading post, and are often composed of just the store, warehouses, oil sheds, and house of the post manager.

The location of a trading post is dependent upon three factors. The most important is proximity to native hunting areas, from which the post is supplied with raw fur. Secondly, accessibility by sea, in order to bring in necessary trading articles and take out the furs, is important. Fort Ross on Bellot Strait was closed after the supply vessel failed to reach the post for several summers. In addition to accessibility, shelter and landing facilities must be considered, because the short navigation season makes it imperative that the ship be unloaded speedily. The third determining factor is the availability of local sources of fresh water and food. The location of settlements other than trading posts is also fairly strictly determined by geographical factors.

There are about fifty settlements distributed along the arctic coasts, usually from 100 to 200 miles apart. They are supplied by ship either from Hudson Bay and the Atlantic, or from the mouth of Mackenzie River. The few interior posts are served by freight plane in summer and tractor train in winter. The white population at some of the largest settlements varies from fifteen to twenty-five persons, whereas some of the smallest posts may have only two or three residents.

At the settlements most of the homes are sturdily built and well insulated. Supplies of food and coal or

fuel oil are brought in each year, often at the expense of the employing organization. Reserves are maintained in case of emergencies. Radio communication with other arctic settlements and with the "outside" is maintained daily. Although there are fellow whites at most of the settlements, there is a definite feeling of isolation, and this is accentuated when the annual supply ship arrives for a few days and then departs for another whole year.

Aklavik ( $68^{\circ}13'$ ,  $135^{\circ}01'$ ), with nearly two hundred white inhabitants, may be considered the main centre of population in the Western Arctic. It is situated near the mouth of Mackenzie River, on the west bank of one of its many delta channels, and is the meeting place of river tugs and coasting schooners. The long river highway connects Aklavik with the settled regions of Canada, and, as the distributing centre for the Western Arctic settlements, it has a similar function to Churchill in the Eastern Arctic, though of lesser importance.

Small trading posts were established in the vicinity of Aklavik about 1910, originally on the east bank of the river. In 1912, the Hudson's Bay Company bought out the Northern Trading Company's store and began to reap the fur harvest of the delta and the western coast. In 1919 the Church of England built a mission near the Hudson's Bay Company post; in 1922 the Royal Canadian Mounted Police moved their post to Aklavik from Herschel Island; and in 1926 the Roman Catholic Church established a mission there. The radio station was built in 1925. The missions have expanded, and now the Anglican cathedral at Aklavik is the episcopal seat for the Bishop of the Arctic. Two government-supported hospitals with a total of some seventy-five beds accompany the missions. Schools are also operated by both churches. The growth of the settlement has attracted other traders, in addition to those of the Hudson's Bay Company who participate in the rich fur production of the area. Two hotels, a boarding house, and several small restaurants round out the commercial agencies. Aklavik is also an important centre of administration, and there are various government offices and a number of residences for government officials.



Plate 8. Aklavik



Plate 9. Anglican Mission buildings at Aklavik

Aklavik is more easily reached than most arctic settlements in this high latitude. The waters of Mackenzie River provide a cheap transportation route to the delta, and the warmth of the river water causes the tree line to extend farther north. Trees and driftwood are important sources of fuel and building material at Aklavik, 122 miles north of the Arctic Circle.

Scheduled visits by river tugs and commercial aircraft are carried out between the break-up of the river ice in late June and the freeze-up in October. Eskimo schooners generally visit Aklavik in the summer to trade the winter's catch of furs for supplies and luxuries.

Coppermine (67°40', 115°05'). From the beginning of this century, independent traders operated posts in the Coronation Gulf area, at Bernard Harbour, Tree River, Kogaryuk (east of Coppermine), Wilmot Island, and on Kent Peninsula. The missions and the police followed and, for varying periods, used several of these locations. In 1928, the Anglican Mission was built at the mouth of Coppermine River, at which time Coppermine was no more than a semi-permanent Eskimo fishing and sealing camp. The natives found the fishing unexcelled off the mouth of the river and had favourite sealing grounds out in the gulf during the winter. Despite the poor shelter and shallow water, which forced supply ships to anchor a mile offshore, and despite the fact that fresh water was only available up the river, the presence of these fishing and sealing grounds, and the food-producing quality of the river mouth determined the location of the settlement. The Hudson's Bay Company established a store at Coppermine in 1930, a police detachment followed a year later, and in 1932 the meteorological office was built. A nursing station and school have recently been erected and both should be functioning in 1951. The dozen or more buildings that comprise Coppermine are spread for half a mile along a sandy ridge just west of the mouth of the river. The natives pitch their tents between the various establishments and behind the settlement, on the other side of a small swamp from which they obtain drinking water. Screened-in fish houses are scattered along the shore. The buildings are all well painted and the immediate grounds are neatly kept. The settlement, unique in its varied group of establishments, is a centre for dog raising and also exports a certain amount of dried fish to other Western Arctic posts.

Churchill (58°46', 94°10') lies just north of the tree line at the mouth of Churchill River, on the west coast of Hudson Bay. It has the distinction of being the terminus of Canada's most northerly railway, and is Manitoba's most important arctic settlement. This rail link, combined with excellent harbour facilities, makes Churchill an important grain shipping port, although ice conditions in Hudson Strait limit the navigation season to approximately 3 months.

The area about Churchill was practically ignored until the Hudson's Bay Company built a small fort on the east bank of the river in 1719. During the period 1733-1771, Fort Prince of Wales was constructed to command the entrance to the harbour. Samuel Hearne built a small fort and trading post in 1784 on the east bank, which served the area until 1937, when the Hudson's Bay Company decided to erect a large store on the west bank near the railway station and docks. In 1813, settlers for Selkirk's Red River settlement were landed at Churchill and, after a winter of hardship, made their way overland to their destination. Churchill was visited by an increasing number of scientific parties in the 19th century, and the harbour became well known to whalers and other small ships.

Before World War I, work was commenced on a railway to link Hudson Bay with Winnipeg. Studies of the west coast of Hudson Bay showed that the best harbour was located at the mouth of Churchill River, and Churchill was, therefore, ultimately chosen as the northern terminus of the railway. In 1929, the railway was completed, and by 1932, the government grain elevator, docks, and harbour improvements were finished. A water supply for the expanding town was obtained by the creation of a large reservoir nearby.

After 1931, Churchill grew slowly as the shipping and railway facilities were not exploited to any great extent because of the economic depression of the times. Most of the residents were then, as now, connected with the railway and elevator, and employment was seasonal. The town acquired a more varied character when the Hudson's Bay Company, the R.C.M.P. post, and the Anglican Mission moved to the town proper, when the Roman Catholic Mission was established as the centre of the Diocese of Hudson Bay, and when small hotels, boarding houses and small stores were built.

World War II added an impetus to the growth of the settlement and Churchill assumed importance for national defence. The port in recent years has expanded in its participation in the grain trade, and in 1949 sixteen ocean-going commercial vessels called at Churchill.

Shipments of grain in 1949-50 totalled over 5½ million bushels, most of it wheat bound for Great Britain. It is interesting to compare this figure with the 170 million bushels shipped from Fort William-Port Arthur in the same year, but during a longer season. Churchill is also an export point for flour, cattle, and lumber. The imports are of a general nature and amount to only about 1 per cent in weight of the outward shipments.

Churchill today has a commercial district that is centred about the railway station, and includes several general stores, a bank, two hotels, restaurants, two churches, a school, post office, and a number of frame dwellings. This district is located on the low, narrow, rocky point of land forming the west side of the harbour. Farther inland are groups of houses for dock and railway workers; Indian shacks and tents; and the bunk-houses of a construction company. The police barracks and wireless station are located on higher land between the two districts.

Churchill is the centre of distribution for the other smaller posts on Hudson Bay. Resupply schooners may make several visits during the summer to load food, lumber, fuel, and other supplies for Port Harrison, Sugluk, Coral Harbour, Chesterfield Inlet, Repulse Bay, and other isolated stations. Churchill is the meeting place for Eskimos and Indians, the latter forming by far the majority of natives in the area. The white population may vary from 500 in the winter to 1,500 in the summer at the height of the shipping season, and the native population in the immediate area numbers several hundred persons.

Port Harrison (58°26', 78°20') is situated at the mouth of Innuksuak River on the east coast of Hudson Bay in approximately the same latitude as Churchill. The port is protected to some extent from wind and ice by the islands that lie off the coast. This settlement is the largest white settlement in Arctic Quebec. The



Plate 10. Churchill, Manitoba

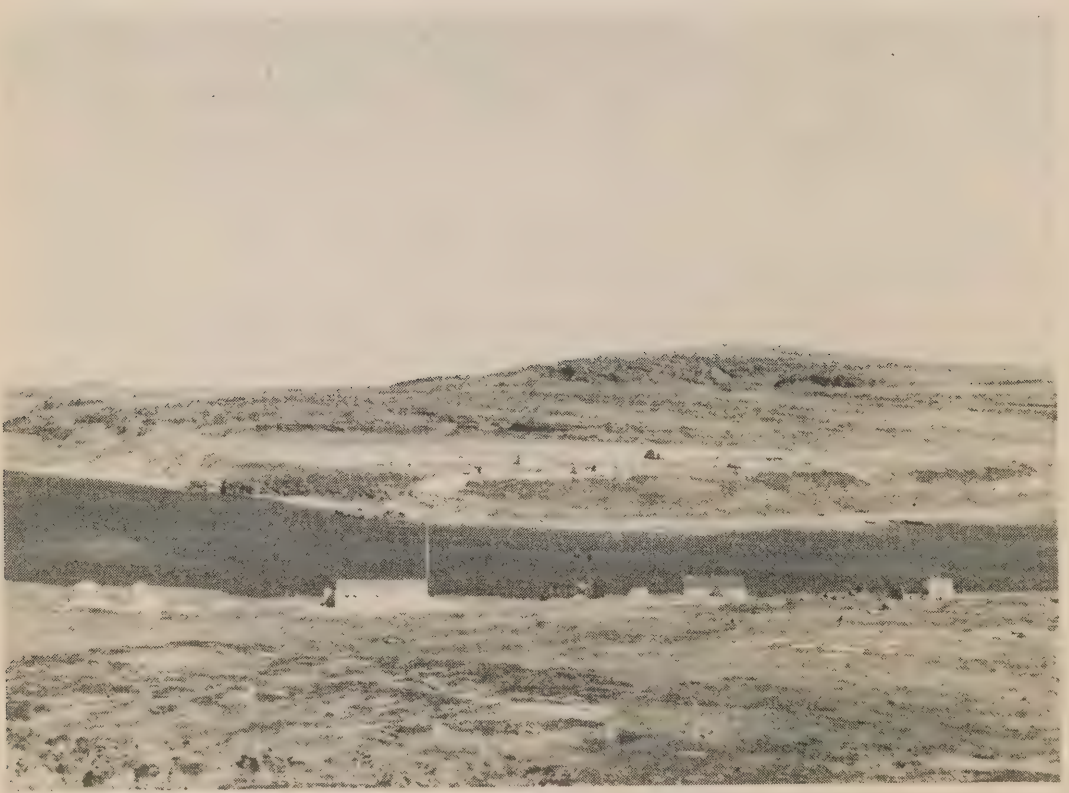


Plate 11. Port Harrison, Quebec

chief buildings are on the east bank of the river; the police detachment and the meteorological station are located on the west bank.

In 1920 the Hudson's Bay Company established a trading post at Port Harrison and in 1925 the Church of England in Canada built a small mission nearby. At present they operate a government-supported nursing station as well. The Royal Canadian Mounted Police occupied a post there from 1935, abandoned it for some years and re-established it in 1945. The Department of Transport has operated a radio station at Port Harrison since 1937, and a meteorological station and post office have also been established there.

The supply ship calls annually, bringing supplies to the various trading and government agencies, and smaller schooners, mainly from Churchill, may arrive during the summer. Vessels cannot tie up, and supplies must be lightered ashore from the anchorage in the roadstead. Peterhead boats can dock at the small jetty by the radio station. Mail is flown in four times a year and is distributed along the coast by small boat, or by the police on their spring sledge trips.

There are some 130 Eskimo families in the Port Harrison area. Fishing is generally good and some walrus are hunted on the Ottawa, Sleeper, Belcher, and King George Islands in Hudson Bay. Sealing is poor, caribou are scarce, and whaling cannot be relied upon. The trapping of white fox varies considerably from year to year, and the proceeds cannot support the native population.

The central location and the presence of one of the better shelters on the east coast of Hudson Bay are the determining factors in the establishment of this settlement. Fresh water is obtained directly from the river flowing through the settlement, and a certain amount of food is obtained in the vicinity. Supply ships are generally undisturbed by weather or ice during their discharging.

Pangnirtung (66°08', 65°28') is situated in narrow Pangnirtung Fiord on the northeast side of Cumberland Sound in southern Baffin Island. The settlement is located on a small sloping terrace at the foot of a ridge of mountains that, a few miles inland, rise to

over 2,000 feet above sea-level. It is the largest settlement in the Canadian Arctic islands.

In the first decade of this century Pangnirtung Fiord was the base for many small whaling vessels, mainly Scottish, and small settlements were created on Blacklead Island, at Kekerton, and at Cape Haven. These were abandoned when the price of whale oil fell after 1910. In 1894, the Church of England established a small mission on Blacklead Island. The Hudson's Bay Company built their trading post at Pangnirtung in 1921, and by 1925 had absorbed the other two smaller trading establishments in the area. The police detachment was established in 1923. In 1926 a government medical doctor was sent there, and a small school and hospital was erected and later enlarged. In 1928, a new government doctor's residence and hospital was built, and an industrial home has been established for some years. The Anglican mission was reopened in 1927.

The largest group of Eskimos in the Canadian Arctic live in the vicinity of Cumberland Sound, and this section provides them with a greater variety of resources than most arctic areas. Sealing and whaling conditions are excellent, and fishing is carried on through the ice of the inland lakes in winter, and in the fiords in summer. Walrus are hunted in August, caribou later in the autumn, and fur-bearers are trapped during the winter months.

The yearly supply ship usually arrives in early September when Cumberland Sound is fairly free of ice. Although the fiord provides seasonally good shelter for ships, a flat rock ledge stretches into the fiord opposite the settlement and prevents the landing of supplies except at high tide.

Pangnirtung, with its variety of establishments, is a more interesting and less lonely settlement than other Arctic stations. Although fresh water must be obtained from a stream at some distance from the dwellings, its position in a region of excellent food and fur supply, the good shelter, and the ease of resupplying the posts are excellent reasons for its continued success as one of the most important arctic settlements.

Dundas Harbour ( $74^{\circ}35'$ ,  $82^{\circ}10'$ ), situated in a sheltered inlet on the east side of Cape Croker on Devon Island, is a typical northern arctic settlement. It is solely a Royal Canadian Mounted Police post today and has charge of the administration of the eastern Lancaster Sound area.

In 1922, the government expedition selected Dundas Harbour as the site of a police post. The barracks were built in 1924 and the post was occupied until 1933 when the police abandoned the station. The Hudson's Bay Company then occupied the site and operated a small trading establishment for 2 years. The site was completely unoccupied for the next 10 years, but in 1945 the R.C.M.P. re-established their post and a post office. Today, the two constables are the only permanent inhabitants.

Dundas Harbour has a strikingly scenic location, with steep cliffs rising behind the post. The buildings lie on a narrow strip of lowland facing Lancaster Sound.

There are only a few Eskimos occupying the area around Dundas Harbour. The post is naturally more difficult to supply than more southerly ones, as it is situated near the eastern end of Lancaster Sound where ice conditions are unpredictable. As yet, however, no supply ship has failed to reach the post.

It is a lonely life at such an isolated station, but police duties keep the men busy throughout the year, especially in spring, when sledge trips are made to other islands and other posts are visited.

Hebron ( $58^{\circ}12'$ ,  $62^{\circ}38'$ ) is the most northerly of the settlements of the province of Newfoundland. It is situated on a narrow coastal shelf within a well-protected harbour on the northeast side of Hebron Fiord. Inland, the location is backed by a precipitous ridge.

The United Brethren of the Moravian Mission, who established their fourth mission station on the Labrador coast at Hebron in 1830, helped to establish friendly relations between the Eskimo and the Newfoundland fishermen visiting the coast. In addition to teaching, the missionaries introduced modern techniques in the catching and curing of seal, trout, and cod, and also established trading posts.

The Hudson's Bay Company established a post at Hebron in 1926. In 1943 this was taken over by the Newfoundland Government's "Northern Labrador Trading Operations".

The population, which averages about 150, of whom 130 are Eskimos, is centred around the Moravian Mission. The Eskimos are semi-nomadic, living in four or five different places during the year, depending upon their seasonal activities. Hebron, however, is the centre of economic activity and religious festivals. A police unit and a government store manager are stationed there. In addition to the mission buildings, there are thirteen one-story houses built of wood, and five of sod. The houses are widely separated along the western side of the harbour.

## CHAPTER VI

### THE CANADIAN ESKIMO

The Arctic region contains all of the Canadian Eskimo population, which is scattered in small families or groups of families in the treeless southern Arctic islands, and on the mainland north of the tree line. Except for about one thousand Eskimos living in west-central Keewatin District and northeastern Mackenzie District, the Canadian Eskimo is a coastal dweller, obtaining most of his food and clothing from the abundant sea life, and supplementing it with the land animals that he hunts inland upon occasion.

Modern civilization has brought many changes to the Eskimo, but most of them today still live the primitive life that was their common lot when the white trader first found them. Many of them, it is true, have left their primitive weapons and have taken up, instead, firearms and the fishing net. The kayak, also unique to Eskimo culture, holds its own in the Eastern Arctic, but the Eskimo, fascinated by mechanics and most skilful in handling machinery, has turned to motor boats with keen delight.

#### Population and Distribution

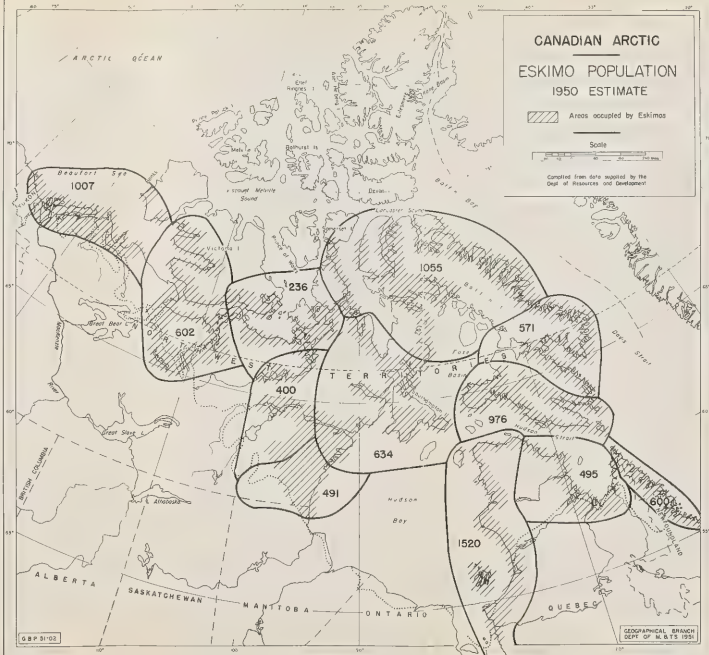
According to a 1950 estimate, based upon reports of the number of identification disks issued by the District Registrars of Family Allowances and Vital

Statistics, the Canadian Eskimo population is about 9,000. Each official census has recorded a larger number of Eskimos, but part of the increase is due simply to more Eskimos being counted as more of them come into contact with white settlements and police and missionary patrols. There is no doubt that improved conditions have increased the population by reducing the infant mortality rate. The Eskimo's food supply is now supplemented by groceries from the trading store and children's diets are improved by recommended foods that are given in Family Allowance credits. There is, therefore, less danger of starvation than formerly when the Eskimo depended wholly on migratory game.

Canadian Eskimos occupy an area of over 800,000 square miles, giving an approximate density of population of one Eskimo for every 100 square miles. In theory, the average Eskimo family has about 400 square miles from which to obtain its food, but a great part of this area is quite barren. Most Eskimos live on narrow coastal strips and seldom move more than 20 or 30 miles from their main camps, therefore, the average of about 5 miles of coastline per Eskimo is a more significant figure than density per square mile. In Arctic Quebec, where on the average the Eskimo has only about 2 miles of coastline, and where caribou have almost disappeared from the interior, it is notable that health conditions are poorer and relief ration payments are higher.

Nearly 75 per cent of the Canadian Eskimo population lives in the Eastern Arctic region. Out of the approximate total of 9,000, about 2,400 Eskimos live along the coast of Arctic Quebec and 600 along the coast of Arctic Newfoundland. In the District of Keewatin there are about 1,400 and on Baffin Island in the District of Franklin about 2,600. There are only some 2,000 Eskimos living in the Western Arctic region.

Eskimos are a migratory race, few in number, and spread over a vast area with limited transportation facilities. Because wildlife resources are not concentrated in any one area, neither are the natives. They use a trading post as their usual centre in each local area, and their numbers may be said to be tributary to that post. Within the section, however, they move from camp to camp, following their usual hunting and trapping activities.



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## Origin

It is believed that the Eskimo is Mongoloid in origin, for his short stocky build, hairless face, and eyes often a little aslant, are typical of those of ancient Asian peoples. However, the history of the group migrations and the cultural evolutions that have brought about the present distribution of living Eskimo and of extinct cultures, revealed by archæological remains, continues to be obscure. It seems probable that the Eskimo are descendants of people who migrated eastwards from Siberia to the Alaskan coast and thence across the Canadian Arctic to Greenland where they came in contact with Norse settlers from Iceland approximately 1,000 years ago.

The interrelationships of the various prehistoric cultures: Ipiutak, Old Bering Sea, Panuk, and Birnirk in the west; and in the east, the Dorset, and Manitunik of the Belcher Islands, have not yet been worked out. However, the Thule, an Eskimo culture originating from northern Alaska, appears to be the immediate predecessor of the present day life of the Canadian Arctic littoral.

## Social Organization

Unlike the Indian to the south, the Eskimo were not organized into tribes, but the larger groups and the individuals who made them up were usually known by the name of their particular settlement, followed by the suffix "miut", meaning "people of" such-and-such a place. These bands of individuals, related by blood or marriage, and thrown together as a result of circumstance and the accident of living in the same vicinity, elected no leaders and recognized no authority, but frequently followed suggestions made by the most able member. There were no recognized laws, but it was generally acknowledged that misfortune might follow the infringement of various taboos. People who were frequent sources of trouble and who disturbed the peace of the community were usually put to death after it had been decreed by a consensus of opinion in the group. People who were crippled, invalid, or too aged to support themselves were generally looked after by others, but often the aged, unable to keep up with the band on their frequent journeys, would ask to be put to death or left behind so that they would no longer be a hindrance to their fellows.

There were no ceremonies attending marriage or burial and very few community festivals.

The various tasks in an Eskimo community were divided evenly between the men and women. The men were responsible for building winter houses, for procuring food by hunting and fishing, and skins for clothing. They also built the kayaks and sleds, fashioned weapons, and made tools and the few scanty articles of furniture that they possessed. The women looked after the cooking, dressing the skins, and making the clothing for all the members of the family. They were responsible for erecting the summer tents and often assisted the men in the building of the winter houses.

This division of labour is still common. Both men and women work industriously, for there are always many things to be done in an Eskimo household.

### Hunting and Fishing

The Eskimo year has always been sharply divided into summer and winter. In summer the people go inland to hunt caribou, they live in tents, travel in boats, wear lighter clothing, and the winter equipment is laid aside. When the inland lakes are still frozen the Eskimo fish through the ice, collect birds' eggs for food, and live almost entirely off the land.

In winter all this is changed. They live on the sea coast, frequently on the sea ice several miles from the actual shore, and much of their time is devoted to the hunting of seals. There are various methods of seal hunting, but the chief method is to harpoon the seal when it visits its breathing hole. Seals are also hunted in summer with the kayak and a harpoon of a different type, and it is at this period that the walrus, narwhal, and (in previous years) the whale were hunted.

Fishing is usually done by jigging, a method in which fish are attracted to the neighbourhood of the hook by means of a brightly flashing lure of ivory, and are snagged as the hook is jigged up and down in the water. Nets do not appear to have been used before their introduction by white men. In some areas fish were caught by damming streams or the outlets of small lakes and the fish taken with aleister, a type of fish spear.

The principal hunting implements have long been the harpoon and bow. The distinctive feature of the harpoon is that it is armed with a detachable head that penetrates the animal's hide readily and toggles when a strain is put on the line to which it is attached. This enables the hunter to hold on to the animal until he is able to dispatch it with a lance. The bow is usually made of spruce wood or a combination of wood, antler, and horn, often backed by a strip of leather and frequently reinforced by an intricate lashing of braided sinew. The arrows, also of spruce wood, are headed with piles of stone (chipped chert or ground slate), bone, ivory, or antler.

The modern Eskimo relies more on the gun for hunting and only the primitive hunters still use the traditional weapons.

The food of the Eskimo is mainly animal in origin, and in all probability their custom of eating not only the muscle tissue but also part of the fat, the endocrine glands, brains, and intestines has much to do with making available the vitamins and hormones essential to survival. Vegetable food is scant and seldom used. Boiling is the usual method of cooking and in normal conditions hot meat and hot soup were always available. Some foods are frozen, sliced thin, and eaten raw, but it is not usual to eat unfrozen raw meat except by necessity. The belief that Eskimos eat blubber and other fats as a delicacy is completely erroneous.

Fire used to be obtained by striking sparks from two lumps of iron pyrites or by the use of a fire drill. Whale oil and seal oil extracted from blubber were the usual fuels in the stone-lamp, and the wick might be of matted moss roots or the downy seeds of Arctic cotton.

Today, the Eskimo who comes into contact with the trading posts often uses a wood or oil stove, and supplements his diet with a variety of canned goods.

### Housing and Clothing

A suitable shelter from the rigorous Arctic weather has always been a major problem for the Eskimo. In some areas, particularly the eastern and western extremes of their habitat, sufficient wood is available, either in the form of driftwood or from nearby timbered areas,



Plate 12. Eskimo family at Bathurst Inlet



Plate 13. Eskimos at George River, Quebec

to permit the construction of semi-subterranean huts. In these same areas, when wood has not been available, similar buildings have been constructed with sods, the bones of whales, and large stones as building materials.

In those regions where driftwood is less often available or impracticable, dome-shaped huts are constructed of snow blocks. These are so constructed that the walls slope gradually inwards as they rise, and a key block in the centre of the dome serves to lock the whole structure solidly together. These huts are circular in ground plan and, ideally, the blocks of snow used in their construction are cut from the interior of the house-to-be, leaving half the floor area at its original level to serve as a sleeping platform. More permanent buildings of this type, intended to last for most of the winter, are frequently quite large and sometimes several rooms are built adjacent to the main room and served by a common entrance tunnel.

During the summer, tents are the usual form of shelter. These used to be of seal or caribou skin, sometimes with the hair still on and sometimes made of skins that had been scraped thin and translucent. Tents necessitated poles for their erection and these sometimes were difficult to obtain, with the result that long strips of bone or other temporary expedients were utilized. Today, canvas tents are common.

The Eskimo household is unusually rich in utensils and mechanical equipment. The men often possess a fairly extensive collection of tools, including knives, scrapers, drills, and other implements needed in the making of their hunting equipment and household furniture. Most of the tools used to be of stone, some of bone or ivory. In the Coronation Gulf area, and occasionally elsewhere, tools of copper were used.

Household equipment has customarily consisted of culinary utensils, including lamps and cooking pots carved from soapstone, bowls made of wood, baleen, or horn; spoons and ladles of horn; wooden tables, and drying-racks suspended above the seal-oil lamp, and a variety of smaller tools such as needles, needle-cases, and thimbles. Among the women's tools were skin scrapers, awls, and lacing-needles.

Throughout the Arctic, Eskimos live in semi-permanent camps usually made up of a few families, which, on occasion, may number as many as one hundred persons, and these settlements are the closest approximation to a native village that these migratory people have. '

Winter camps are so chosen as to fulfil two chief functions: to provide a coastal location, which allows Eskimo hunters to go out on the sea ice and harpoon or shoot seals; together with location near a trap line, which allows the Eskimo to visit his traps periodically during the season from early November to the end of March.

Summer camps are usually located on offshore islands or at the mouths of rivers. Today, these shelters are usually of canvas, but some coastal Eskimos still use the seal-skin tent, and the inland people often use caribou-skin tepees. If the camp is on an island, it is from there that the Eskimo hunter leaves in his imported wooden boat or skin kayak to hunt seal and walrus. A camp near the mouth of a river allows fishing in July when the fish are going out to sea, and again in September when they are running upstream.

Eskimo clothing is commonly made from skins, those of the caribou and seal being most frequently used, and those of other mammals such as the ground squirrel and polar bear, and some bird skins, less frequently. Clothing is made by the women who cut the skins from intricate and exact patterns, which they retain in their minds and which they modify with astonishing skill to fit the individual. Sinew is used as thread, and sewing is done with a needle or with an awl. Clothing must be kept in constant repair, and for this reason a woman skilled in sewing usually accompanies the men who are travelling afar.

In extreme weather, caribou clothing is best as it is light and warm. Hunters who expect to be out of doors for long periods frequently wear two suits of caribou skin clothing - the outer suit with the hair on the outside, and the inner one with the hair on the inside. Lighter caribou skin clothing, cut from the short-haired summer coats, is used in milder weather. In the summer, clothing, especially work clothes, is made from the skin of the common harbour seal, which is strong and windproof.

The usual garments are a tunic-like coat, which reaches just below the top of the thighs, and a long pair of leggings. Footgear is of various types including waterproof boots of seal skin, which are almost knee high. Gloves and mitts are worn extensively, and in winter soft fur socks are worn inside the boot.

The cut of the clothing varies from one area to another and in some districts, such as the west coast of Hudson Bay and Coronation Gulf, it is attractive in appearance, being highly decorated with beads and coloured braid or by the use of narrow parallel strips of brown, white, red, and black skins. The upper part of the tunic usually terminates in a peaked hood.

Eskimo-styled clothing, in fibre cloth, can now be bought from traders and is popular in the larger settlements.

### Language, Art, and Religion

The Eskimo language from Alaska to Greenland is singularly uniform. Minor dialectical differences occur, but these are not so marked as to make intercourse difficult between peoples from various groups. It is probable that the language from which modern Eskimo is derived was spoken by a Paleo-Asiatic people now extinct and whose language has perished with them. The Eskimo language is of great complexity and contains a large number of verbal forms, permitting the expression of shades of meaning much more refined than English usage allows. It is agglutinative in type, so that the addition of a single syllable to an already complicated word will modify its meaning. There was no written script, but a form of syllabic writing was introduced to the Eastern Arctic by a missionary in the latter half of the 19th century and accepted with great enthusiasm by the Eskimo. In the Western Arctic there has been a tendency for the Eskimo to read and write English to a much greater extent than in the east, whereas in the west the syllabic script is unknown.

There has been little opportunity for the Eskimo to express any artistic inclination, but in the carving of small ivory figures he has long been amazingly successful. Archæological excavation, as well as modern ethnological study, has revealed a host of small figures

of men, animals, and inanimate objects such as kayaks and sleds carved with considerable artistic ability. The innate artistry of the Eskimo shows, too, in his everyday tools and weapons, which are made with an appreciation of line and form seldom surpassed by native craftsmen anywhere. In the non-plastic arts music was developed among the Eskimo but remained restricted, as they had no musical instruments except a single-headed drum. Both men and women sing frequently and with enthusiasm, often composing the words and the melodies of their songs. In literature there is a large collection of folk tales, which though never committed to writing are nevertheless familiar in some cases from one end of the Canadian Arctic to the other.

There was little in the way of formal religion. The Eskimo believed that many animals and inanimate objects had indwelling spirits that might or might not be harmful. Some individuals professed a power over these spirits and would communicate with them while in a trance. Some of the more important nature spirits were known as individuals and had personal names such as Sedna, the goddess of sea mammals, under whose protection were all seals, walrus, and whales; and Shila, the goddess or spirit who controlled the weather. Though the existence of innumerable spirits was readily admitted, the concept of a Supreme Being had not been arrived at and the idea of life after death was vague and unformulated.

### Regional Groups

Western Arctic. The Eskimos of the Western Arctic may be subdivided into three chief groups.

The most westerly Eskimos inhabit the Mackenzie delta area and are found between Herschel Island and the former post at Baillie Island. These people are primarily trappers and have changed greatly from the primitive hunters of a few decades ago. In the spring they migrate to the northern half of the Mackenzie delta to trap and shoot muskrat. The Eskimos of the delta coast, unlike the remainder of the Canadian Eskimo population, live in driftwood or frame houses most of the year. However, when they are travelling along trap lines, they live in the traditional snow house or in tents banked with snow blocks.

The largest group of Western Arctic Eskimo inhabit southern Victoria Island and the mainland region east of Coppermine to Perry River. Some of them are great travellers, but their movements are quite irregular and vary from season to season. The Copper Eskimos, who hunt inland southeast of Coppermine settlement, prefer caribou to any other food, and as long as they have sufficient meat, or can hunt small caribou herds, may stay on the barren grounds throughout the winter. If caribou are lacking, however, the families migrate to the coast in winter or spring and begin sealing. A similar group lives inland from Bathurst Inlet and follows caribou most of the year, coming to the coast occasionally, chiefly for the sealing in April.

The Eskimos on southeastern Victoria Island, around Cambridge Bay, are one of the more prosperous and progressive groups, and inhabit the coast from Wellington Bay around to Albert Edward Bay. They spend the autumn fishing the streams and lakes, and hunting seal along the coasts until freeze-up using manufactured boats with gasoline engines. From the beginning of November they trap the white fox, each man having his own region with trap lines extending probably 40 to 70 miles and averaging 200 traps. In April the families assemble at favourite sealing grounds along the south and southeast coast of Victoria Island. The spring sealing lasts until early July when the ice begins to break up. Then the Eskimos gradually assemble around the Cambridge Bay post, bringing in the remainder of the winter's haul of white foxes and awaiting the arrival of the annual supply schooner.

The third group are inland people who live along Back River and Garry Lake. These primitive people stay inland most of the year, existing on caribou and fish, and are little concerned with trapping. A larger primitive group, the Netsiliks, are primarily coastal dwellers, who owing to their isolation have been little affected by the influence of the white man.

Eastern Arctic. In Keewatin District there is a balanced adjustment between the population and the wild-life resources of the area. A coastal population inhabits the region from Eskimo Point to Repulse Bay, living on seals, white whales, fish, and the occasional walrus, and making a few trips inland for caribou skins in the

autumn. About half of the native population are the so-called "Caribou Eskimo" who live inland most of the year, obtaining much of their food and clothing from caribou.

Baffin Island has a large coastal population, with about two-thirds living in the south. Many parts of the interior are unproductive or unused. However, this unproductiveness is balanced by the fact that the island is greatly indented with many broad bays and numerous long narrow fiords, giving the Eskimo access to miles of coastline for hunting seals.

In the Arctic section of Northern Quebec the Eskimo standard of life is not as high as in some other sections of the Arctic. One of the reasons for this is the comparative density of population and the limited wildlife resources of the land and the sea.

## CHAPTER VII

### TRANSPORTATION AND COMMUNICATIONS

#### TRANSPORTATION

There are no railways or roads within the Canadian Arctic to give an all-season means of transportation. As the small trading and administration centres can be supplied by sea and air, there has, as yet, been no reason for the construction of either roads or railways. Because the Arctic coasts are ice-bound for many months of the year, water transport is solely a summer function. Air transport has now made the Arctic more easily accessible throughout the year.

Two railways give access to the southern parts of the region, one to Churchill and one to Moosonee. The primary function of the railway to Churchill is to transport grain for shipment by ocean-going vessels by the Hudson Bay route to the Atlantic; the railway to Moosonee provides an outlet for northern Ontario, limited by the shallow water of James Bay to small schooners.

#### Summer Transportation

The length of the season of navigation decreases from about 3 months in Hudson Bay and Hudson Strait to zero in most years in the far northern islands. The most dependable transportation is supplied by ice-forcing ships with reinforced sides. Prior to its sinking in 1947, the R.M.S. *Nascopie* was the Hudson's Bay Company's

annual supply ship, and, in addition, it carried the Government officials, doctors, and scientists of the Eastern Arctic Patrol. The ship has now been replaced by the *Rupertsland*, which carries the Company's supplies to the Hudson Strait and Hudson Bay area. The *C.D. Howe*, a government ship, reinforced against ice, was launched in 1949. It carries government administrative officials, scientists, and supplies, chiefly to the Eastern Arctic Islands. The *N.B. McLean*, the Department of Transport ice-breaker, aids ships in the navigation of the Hudson Bay route. It enters Hudson Strait early in the season and checks and services all navigation aids, such as buoys, lights, and direction-finding stations. During the summer it patrols the route, helping ships with instructions and supplying information concerning ice conditions. Other large ships in the Eastern Arctic during the summer are the grain and cargo vessels travelling the Hudson Bay Route to well-sheltered Churchill harbour.

Owing to the shallow water in James Bay and along much of the coast of Hudson Bay large ships are unable to approach several of the settlements, and supplies are carried by small schooners. These schooners, with 50 to 100 tons capacity, are stationed at the two railroad terminals of Moosonee and Churchill. They make several trips each season up and down the eastern and western coasts of Hudson Bay. As they are not constructed to combat ice, their operations begin only after the harbours and coasts are free of ice.

In the Western Arctic, summer transportation is also by small schooners. Supplies are brought down the Mackenzie River system on flat-bottomed boats and barges, and transferred to coastal schooners at Tuktoyaktuk. As soon as the ice has cleared away from the coasts of Beaufort Sea and Amundsen Gulf, the ships proceed eastward to Coronation Gulf. Supplies for the Queen Maud Gulf region are usually trans-shipped again at Cambridge Bay to small Eskimo-owned vessels. At one time, Western Arctic supplies were brought in around Alaska from west coast ports. This route gradually declined in use, owing to the distance and the unpredictable hazard of great ice fields pushing southward against the north Alaska coast.

Eskimo boats are of several types, dependent upon the economic status or habits of the people in the local

area. Peterhead boats, which are decked vessels about 40 feet in length and usually powered by a gasoline motor and an auxiliary sail, are owned by the more prosperous Eskimos. Smaller whaleboats, however, with oars and a sail, are a more common means of family transportation. There is also a variety of small outboards, dories, and canoes used for hunting and travelling. All are obtained from the trader in exchange for white fox pelts. The skin kayak, the style of which is distinctively an Eskimo invention, is still used as an effective hunting aid, chiefly in the Hudson Strait area, but it is gradually disappearing. The manoeuvrability and almost-silent speed of a kayak make it efficient for shooting and harpooning sea mammals in the water, but it is difficult to construct and does not have the durability of manufactured wooden boats.

### Winter Transportation

Winter transportation in the Arctic, other than by air, is almost entirely by dog-team and sled. This method of travelling has been used for centuries by Eskimos and has been adopted by whites as the most logical means of transportation. The "highways" are the miles of sea ice that freeze along the coasts during the winter. The ice is often smooth but in places becomes rough and hummocky where it is compressed into ridges by storms. Overland travel in winter, when the lakes are frozen and the snow becomes deep enough for sledging, is easier than summer travel across the water-logged surface of the land.

The sledges, or "komatiks", that are used in the Eastern Arctic are long and narrow. They are from 15 to 25 feet in length, depending upon local preference and the type of surface over which they must travel. Supplies and equipment are lashed to the flat cross-pieces and the sled is usually guided from the front. As much as 1,000 to 2,000 pounds may be carried in this fashion, depending on how many dogs are in the team.

In the Western Arctic where sea-ice is generally smooth over the enclosed seas and elevations are low, dogs are hitched in a long, double line, and pull as a unit. With good weather, distances of 30 miles or more a day can be covered by dog-team. One of the problems of winter transportation is the periodic occurrence of

epidemics that kill many of the dogs. Autopsies of a few cases indicate that the disease is rabies, and the occurrence of the disease seems to relate to the periodic epidemics that decrease the number of white foxes.

The husky dogs of the Eastern Arctic pull the sledge from a "fan-hitch", by which each dog has a separate line of different length attached to the front of the sled. In this way each dog can pick his own way over rough ice or rough terrain, and pull individually.

Attempts have been made to use tractors or snowmobiles to haul supplies over the sea-ice and frozen ground, but the cost of imported fuel is high, whereas dogs can live on local fish and game. Tracked vehicles have been used successfully in local areas, and could be more widely used if the need arose. For example, the personnel in "Exercise Musk-Ox", carried out by the Canadian Army in 1946, travelled in snowmobiles from Churchill to Cambridge Bay, thence to Coppermine and into the Subarctic. The expedition had to be continuously supplied with fuel and spares, however, by the Royal Canadian Air Force.

### Air Transportation

Travel by air has made the Arctic accessible the year round. Seaplanes in summer and skiplanes in winter are the usual means of transportation, except at the larger bases where wheel-using planes land on runways the year round. In the period of break-up and freeze-up these are the only planes available, the ski or pontoon type being then unfit for use.

In a region of so many lakes and rivers, there are numerous natural landing places for float-equipped planes. Further, most settlements are located on the coasts. In winter, skiplanes can land on the thickly frozen lakes and the smooth sea-ice of the harbours.

Flying faces a number of natural hazards in the Arctic. Fog and overcast, common in the summer but most prevalent in the late spring and early autumn, are the chief obstacles.

The best season for flying in the Arctic is late winter and early spring when there are sufficient hours

of daylight, good visibility, and high ceilings. Mid-winter flying is hampered by the short period of daylight in these high latitudes, and blowing snow obscures the landing surface. In summer, the days are long, however, and this helps to balance the disadvantages of poorer flying weather. The following table records the number of hours of daylight between sunrise and sunset at various Arctic latitudes in certain seasons. As much as 2 hours of twilight, depending upon latitude and season, should be added to these figures to give actual hours of daylight.

Lat.	Jan. 1	Feb. 1	Mar. 1	Apr. 1	July 1	Aug. 1	Sept. 1	Oct. 1
60	6	8	10 1/3	13 1/4	18 1/2	17	14 1/4	11 1/2
65	3 2/3	6 3/4	10	13 1/2	21 1/2	18 1/4	14 3/4	11 1/3
70	0	4 3/4	9 1/4	14	24	21 1/2	15 1/2	11 1/4
75	0	0	8 1/3	14 3/4	24	24	17	11

Navigation by both air and water must overcome the problem of rapidly changing magnetic variations in the Arctic. The North Magnetic Pole, formerly located on the west side of Boothia Peninsula, has gradually moved northwestward to central Prince of Wales Island.

As the magnetic pole is approached the horizontal attraction becomes weaker. Friction of the ordinary pivotal compass is greater than the magnetic attraction within about 100 miles of the Pole. The compass needle tends to dip downward or spin lazily, instead of pointing in the direction of the Magnetic Pole. In the Arctic, there are several areas of local magnetic disturbances where the compass needle spins uncertainly; some of these areas are known and mapped, but others possibly exist and await discovery.

The future accessibility and development of the Arctic may be linked with progress in world air transportation. During World War II, air bases were built at Churchill, Southampton Island, Frobisher Bay, and Fort Chimo, connecting air fields at The Pas, and elsewhere in Western Canada, with bases in West Greenland and Iceland. They had only limited use after the construction of the excellent field at Goose Bay, Newfoundland. Only the Churchill airport has maintained some relative importance as the centre for winter exercises of the Canadian Army and the Air Force. Long distance flying

over the region at present faces competition from other air routes farther south with better emergency facilities and greater possibilities of shorthop freight and traffic from the populated areas of Canada and the United States. Although distances are shorter over the Arctic, bases are expensive and difficult to maintain for commercial flying, and the lack of resources fails to give any local impetus.

Since the war there has been a greater use of float and ski-equipped aircraft for emergency and inspection flights. These planes do not need permanent bases, and can land easily in the harbours of all settlements. Air bases are still necessary, however, to supply weather stations that are beyond the range of ocean transport, or in areas where the sea-ice does not break up. These bases have been additionally valuable for photographic aircraft used in mapping Northern Canada.

### The Northwest Passage

The search for the Northwest Passage over the last 3 centuries was the stimulus behind the discovery and charting of the coasts of many of the Arctic islands. Ice movements, however, always prevented any ship from travelling all the way through in a single season. The tiny *Gjoa*, under Amundsen, was the first to complete the passage from east to west. Amundsen travelled along the Arctic mainland in 1903-6, after wintering on King William Island, and on the Yukon coast. In 1940-42 the Royal Canadian Mounted Police schooner *St. Roch*, under Captain H. Larsen, became the first ship to accomplish the passage from west to east. This floating police detachment spent one winter on western Victoria Island, and the second winter on western Boothia Peninsula before entering the Eastern Arctic through Bellot Strait.

In 1937, the Hudson's Bay Company ship *Nascopie* from the Eastern Arctic met the Company's small schooner *Aklavik* from the Western Arctic, during the opening of the Fort Ross trading post on Bellot Strait. At that time, goods were exchanged, making the first commercial use of the Passage. The practice was discontinued in 1940, however, as it proved uneconomical.

The historic Northwest Passage was finally conquered within one season by the Royal Canadian Mounted

Police schooner *St. Roch*. The sturdy vessel sailed from Halifax in July 1944 and passed north of Baffin Island into Lancaster Sound. By staying close to the south coasts of Devon, Cornwallis, and Bathurst Islands the police schooner reached Melville Island. It then worked and drifted across ice-jammed M'Clure Strait to Prince of Wales Strait, west of Victoria Island, and completed the record-breaking trip by continuing around the coast of Alaska in October.

The possibility of a Northwest Passage has become greater with the development of powerful ice-breakers, as modern ships have more power and control over their movements than did the sailing vessels of earlier days. The greatest difficulty is that ice conditions vary from year to year. In addition, the shallow areas in Queen Maud Gulf prohibit large ships from travelling the western half of the southern route, and the possible passage through the deeper water of the northern route in Viscount Melville Sound and M'Clure Strait has been blocked at each attempt by ice moving eastward from the Arctic Ocean.

The economic importance, however, of the Northwest Passage appears doubtful because of the small amount of possible local trade between the Eastern and Western Arctic and the high cost and risks to commercial vessels.

## COMMUNICATIONS

### Radio

Communication between the Arctic and the outside world is not so limited as transportation. Most settlements (including all Hudson's Bay Company posts) are equipped with two-way radios for conversation by code, and, from many places, by voice. Although the radio communication of most trading post stations is limited to a radius of a few hundred miles around the settlement, a system of relaying messages and funnelling them through the more powerful Department of Transport stations, permits all centres to communicate with each other and with headquarters in Southern Canada. Radio communication, however, is often hampered by atmospheric disturbances, and there are periods when messages appear to escape into the outer layers of the atmosphere instead of being reflected. This tendency seems to be more prevalent in summer.

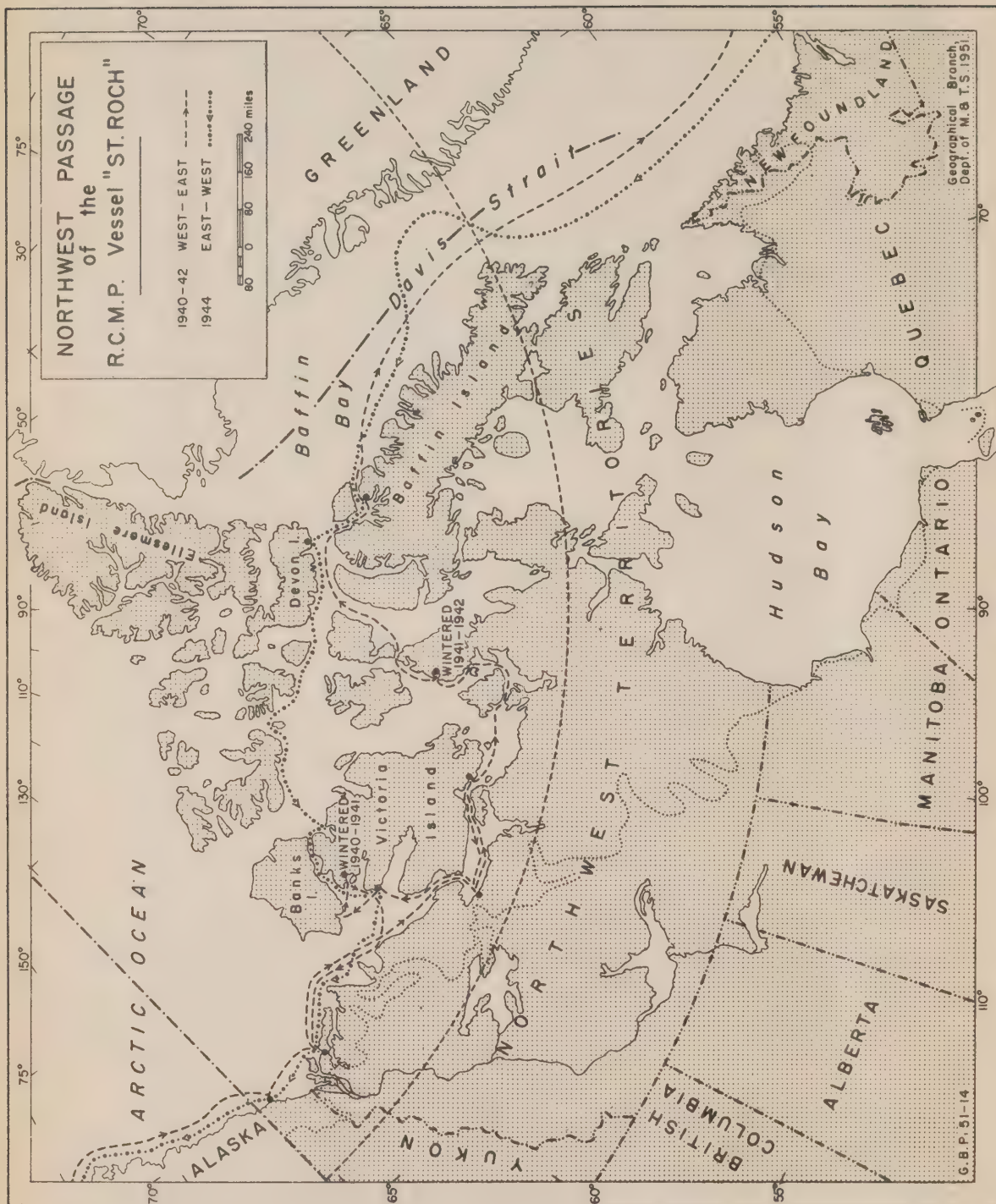


Figure 14. Northwest Passage of the R.C.M.P. vessel *St. Roch*.

As there are only a few hospitals and nursing stations in this vast area, radio communication is used to give medical advice to far-distant posts. A report on a case can be radioed to the headquarters of the government doctor. He, in turn, replies with instructions on the use of supplies in the government medical kits that have been placed at each centre.

### Mail

Communication by mail is becoming more frequent with increasing air services throughout the north. Mail is always carried on the supply vessels during the summer months, and a travelling post office is located on the government supply ship. Mail for the Eastern Arctic is centralized in Ottawa, "c/o Eastern Arctic Patrol R.M.S.". Three mail flights are made north of Churchill as far as Chesterfield Inlet during December, February, and April. Along the east coast of Hudson Bay there are four flights from Moose Factory to posts as far north as Port Harrison in January, March, June, and September. In the Western Arctic two scheduled flights are made between Yellowknife and Coppermine in July and December, and monthly flights are made during the winter to the Mackenzie Valley settlements as far north as Aklavik. From these terminal points, mail is then distributed by dog team by the Royal Canadian Mounted Police, or any other patrolling party.

## CHAPTER VIII

### ECONOMIC RESOURCES

The known resources of the Arctic are few, limited in quantity and quality, and relatively inaccessible to the more populated parts of Canada. In this region there is no possibility of normal agriculture or forestry. It is true that much of the exposed rock is part of the Precambrian complex that has produced wealth in other areas of Canada, and mineral resources are possibly the chief hopes for future economic development. However, at present, the economic life of the Arctic is based on the fur trade.

#### FUR TRADE

The fur trade of the Arctic depends primarily on the trapping of white fox by the Eskimo. A few other furs such as ermine, and red and cross fox are traded, but they are not common in the region. Blue fox, a colour phase of the white, which occur at a ratio of 1 to 3 per cent, are also trapped. In addition, mention must be made of the muskrat resources of the Mackenzie River delta in which nearly 1,000 Eskimos are interested.

However, generally, the white fox is the only resource of the Arctic that has proved valuable enough for commercial exploitation.

The value of the industry fluctuates with the fox cycle and the market price, so that an annual figure

cannot be assessed upon the trade. The annual average yield from white foxes in the Northwest Territories would range from \$300,000 to more than \$2,000,000. Since World War II the demand and market price for white foxes have declined seriously, reaching a record low in 1949 and 1950. Already there are serious repercussions in the Eskimo economy, an economy that has become very closely tied to this one resource.

### Fluctuations in the Fox Cycle

Foxes increase and decrease in number, in cycles of abundance and depletion. The cycle of abundance is generally at a peak every 4 years, as indicated by the number of foxes brought in to the trading posts, but it may occur every 3 or 5 years at some places. Variation in the cycle from region to region is an important factor in the geography of the fur trade. Keewatin District catches show a 3- and 5-year cycle of abundance; there seem to be definite 3-year cycles in the Eskimo Point-Padlei area, consistent 4-year cycles in the Chesterfield-Repulse Bay area, and 3-, 4-, and 5-year cycles at Baker Lake. In the latter case trapping is by a more primitive type of Eskimo, who is still more of a hunter than a specialized trapper, and there are fewer numbers trapped than in the other two regions. Thus, the fluctuation may not actually represent fluctuations of the number of foxes in the area.

In Arctic Quebec the fox cycle has shown an alternate 3- and 4- year cycle since 1933, with a much greater fluctuation in numbers than in other parts of the Arctic. The low years of the cycle record the poorest catches of any part of the Arctic, dropping to a catch of only a few hundred foxes, as compared with peak catches of several thousand at the same post. Unlike the other regions, the poor year follows directly after the peak year.

Although Baffin Island records a definite 4-year cycle of abundance in total, regionally there have been 3-, 4-, and 5-year cycles since 1933. These cycles do not, however, follow the same sequence. For example, northern Baffin Island has twice had its peak in the year after that of southern Baffin Island. Central Baffin Island sometimes has its peak at the same time as the northern part and sometimes as the southern area. The

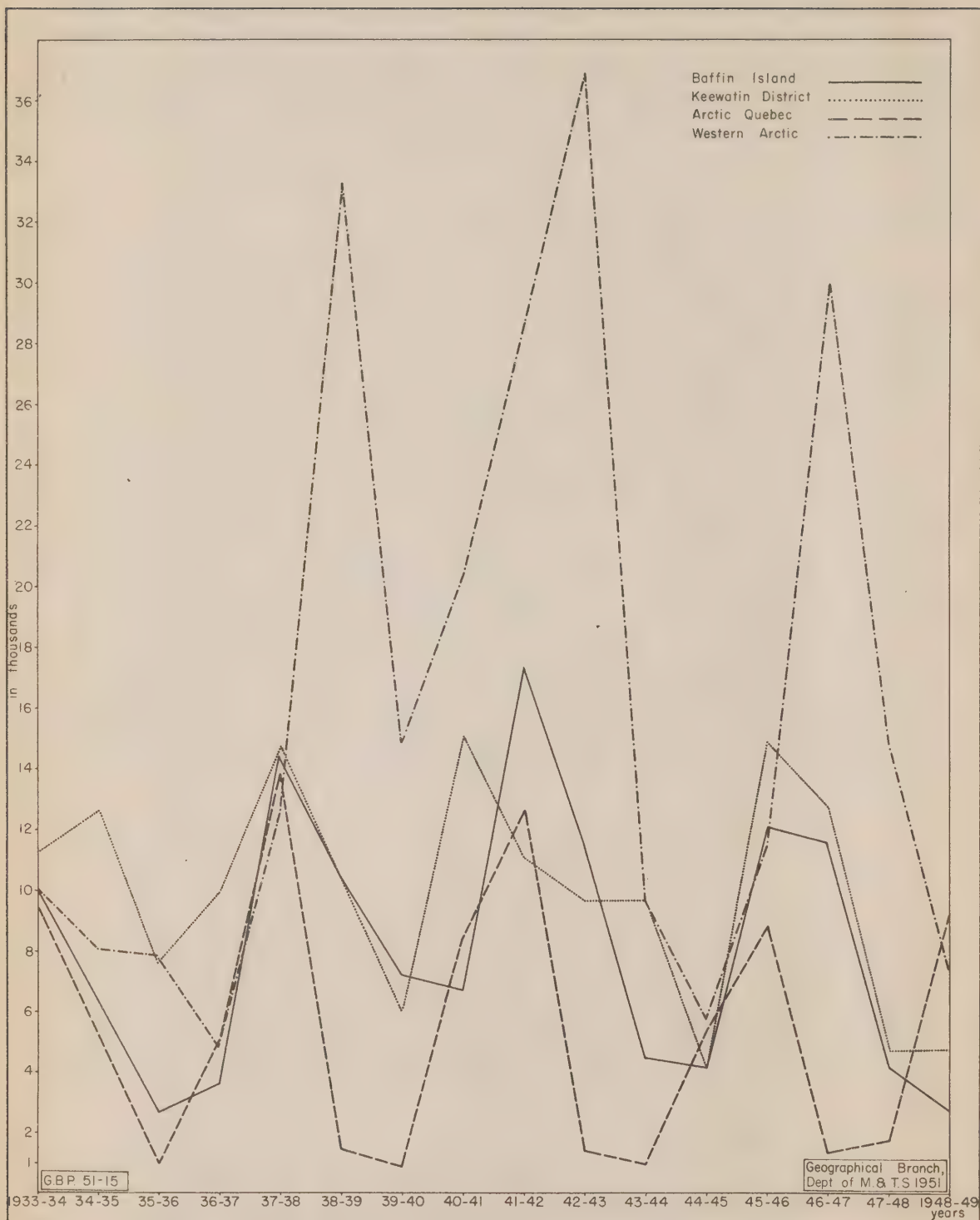


Figure 15. White fox production.

catches of south and central Baffin Island show greater variations from maxima to minima than do those of northern Baffin Island.

The Western Arctic shows a consistent 4-year cycle of abundance. Commercial trapping became very intensive after 1938 and catches of the industrious Eskimo soon raised this area to the position of the leading fur-producing region of the Canadian Arctic. Many of the Eskimo, particularly those around Aklavik and Cambridge Bay, are almost full-time trappers and depend less and less upon local game for food.

Regional variations in the white fox catch are difficult to determine, because, as shown above, there are variations within the cycle of each region. The peaks in Arctic Quebec and Baffin Island have occurred at the same time since 1933, whereas Keewatin District has had peaks once before, once afterwards, and twice at the same time as the other two regions. The Western Arctic, however, has reached a peak of fox catches in the year after the other regions. Although this Western Arctic peak has twice been at the same time as that of northern Baffin Island, there is not enough definite evidence to indicate that the fox cycle moves from east to west.

Although these four main trapping districts have about the same area, and about the same number of Eskimos, there are wide differences in the total number of furs caught. In peak years the Western Arctic trappers turn in almost as many pelts as all other Arctic areas combined. Sometimes, even the low years of the fox cycle in the Western Arctic produce greater numbers than the peak years of the other regions. Keewatin District has been the second fur producer, partly due to the good catches of the few white trappers who operate efficiently in southern Keewatin. Arctic Quebec has had fewer foxes than Baffin Island in most years.

#### REINDEER HERDING

Herds of domesticated reindeer have been established at the mouth of Mackenzie River in the Western Arctic, and are proving a new factor in the economic life of the Eskimo. Stock for this Canadian Government reindeer project was obtained from western Alaska. The



Plate 14. Cape Dorset, Baffin Island



Plate 15. Arctic Bay, Baffin Island

drive across northern Alaska and the northern tip of Yukon Territory to the east side of the Mackenzie River delta commenced in 1929, and was completed, after many difficulties and adventures, in March 1935, by the delivery of 2,370 reindeer to a corral near Kittigazuit. The herds graze along the Arctic coast or near Eskimo Lakes in summer. Richards Island, where the cool breezes from the Arctic Ocean decrease the mosquito annoyance, is the summer range of the main herd. Reindeer feed at that time includes a variety of vegetation -- grasses, shrubs, sedges, mushrooms, etc. The principal roundups are held in midsummer, with further roundups in the winter season, when surplus stock is slaughtered for meat and hides. The winter grazing areas are on the mainland, 50 to 75 miles inland, where there is an abundance of reindeer moss.

The reindeer increased rapidly in numbers on the excellent grazing ground. Branch herds were started under Eskimo management near Anderson River in 1938 and 1940. A serious setback occurred in 1944, however, when the chief native herders and a white supervisor lost their lives in the wreck of a native schooner. The reindeer were scattered and many animals lost. The surviving reindeer that could be assembled were handled as the Government Anderson River herd from 1945 to 1950, when the herd was moved to the vicinity of Tuktoyaktuk and the reindeer were again placed under Eskimo management. In the meantime, part of the main herd was moved in 1948 to the Eskimo Lakes area as a native herding unit. At the annual roundups held in the summer of 1950 the count of reindeer was as follows:

	<u>Head</u>
Main herd, located on the reindeer reserve. . .	4,973
Native herd No. 1, near Eskimo Lakes. . . . .	958
Native herd No. 2, near Tuktoyaktuk . . . . .	<u>1,629</u>
Total . . . . .	7,560

The Canadian reindeer experiment has faced many difficulties in its short existence. The natives of the Arctic areas of northeastern Siberia and of Alaska herd reindeer to find security in a region that lacks other adequate food resources. They derive food, shelter, clothing, and implements from the reindeer itself. Reindeer herding is thus a subsistence rather than a cash economy. However, the Canadian Eskimo has become

accustomed to the cash nexus even if it implies a degree of insecurity. Long a trapper, he is loath to become a herder. The problem is made more difficult as the reindeer herds are located near the Mackenzie River delta, which is one of the best muskrat trapping grounds in Canada.

However, reindeer meat does have a cash value for sale to white settlements and so the Eskimo is taking to herding more freely. This, together with the greater security of reindeer herding as a means of obtaining a regular food supply, may help to make the practice more popular.

## MINERALS

In any consideration of economic mineral possibilities of the Arctic, basic factors of geologic structure and mineralization must share importance with problems of accessibility, transportation, and climate. Some of the Precambrian rocks in the Arctic seem to be similar to those producing minerals in the south, both regarding the kinds of rocks present and their relations with the invading igneous rocks. There is no known reason why they, too, should not be the sites of valuable mineral deposits.

Certain areas seem to be promising whereas others can be ignored for several reasons. The areas covered by ice-caps or permanent snowfields, can be excluded from economic consideration. They include several large sections in Ellesmere Island, most of Devon Island, much of the interior of Bylot Island, and scattered high or mountainous areas of Baffin Island. On the Arctic mainland there are extensive areas of glacial drift where prospecting is difficult or impossible because structure is hidden. Only expensive drilling can reveal with certainty what bedrock lies below.

The exposed bedrock of Keewatin and northeastern Mackenzie Districts, northern Quebec, and Baffin Island consist of Precambrian granites, gneisses, schists, sediments, and volcanic eruptives. These regions appear to be well mineralized and are relatively accessible. Owing to lack of tree growth and scarcity of soil, the rocks are exposed to the prospector wherever they rise above the glacial drift.

One of the most promising areas for mineral development lies along the west coast of Hudson Bay between Eskimo Point and Chesterfield and inland along the belt of rocky hills that extends through the Padlei area to Kasba Lake in southwestern Keewatin District. Prospecting by aircraft was carried on intermittently after an initial intensive flurry in 1928, and traces of nickel, copper, platinum, gold, silver, and iron were reported and preliminary investigations made. None of the mineral deposits however, proved large enough to encourage a mining industry. Prospecting was renewed in 1945 and several field parties have been in the district each summer, particularly in the Upper Kazan River and Padlei areas. Claims have been staked where gold showings are numerous, and development work is being continued. The geology, which shows bands of carbonate rocks, andesites, gold-bearing conglomerates, and quartzites in well-mineralized zones, is being studied by private companies. The area has the advantage of being close to summer ocean transport in Hudson Bay and the nearby rail terminal at Churchill, but the removal of the overburden of glacial drift presents a problem.

Mineralization has been noted at several places in Arctic Quebec. A belt of greenstone extending inland from Cape Smith revealed traces of nickel, copper, and gold, but not in sufficient amounts to warrant development. The region has been barely explored and is similar to other areas of Precambrian rock throughout the Canadian Shield that are considered favourable grounds for prospecting. Lead deposits were mined 200 years ago by the Hudson's Bay Company inland from Little Whale River and Richmond Gulf. Similar deposits in this area are now undergoing further investigation by another commercial company.

An iron formation in the Belcher Islands, Nastapoka Islands, and Richmond Gulf area, on the east side of Hudson Bay, has been known for several decades. Investigations have been carried on by geologists and steel companies, but they report that the formation does not constitute workable iron ore under present conditions. Although the percentage of iron on the Belcher Islands is relatively high, the percentage of silica is considered to be beyond the present limit for commercial development. Another belt of iron formation, similar to that being developed on the Newfoundland-Quebec boundary,

has been traced northward to Koksoak River, south of Ungava Bay. The characteristics of the ore and the problems of accessibility and power are yet to be determined.

Along the south and east coasts of Baffin Island discoveries of mica, graphite, and garnet have been noted. This indented coast has the advantage of being accessible from the Atlantic for several months of the year. Although present deposits are of little value, being either small or of low grade, the fact that mineralization has occurred should point the way to future investigation.

Near Arctic Bay in northern Baffin Island, mineralization occurs along the contacts where dykes have intruded into faulted and folded Precambrian sediments. Although traces of gold, silver, platinum, copper, iron, nickel, and antimony have been reported, no extensive prospecting has been carried on. Against the facts of favourable structure and known mineralization are the problems of long distance from markets, a short and uncertain navigation season, and incomplete geological knowledge of the area.

The numerous coal deposits of the Arctic islands may play an important rôle in the future of a land devoid of wood and developed waterpower. The Tertiary lignite at Salmon River, near Pond Inlet, has been mined in small amounts since 1924, and supplies fuel to the post settlement. Although the coal has high heat value, it crumbles very easily. Investigations encouraged by the Northwest Territories Administration have shown that the coal can be successfully briquetted at a price much below the high freight rate on imported coal. If strip-mining operations are possible and the seams are extensive, an important local mining industry could develop.

In the Upper Palæozoic rocks of the Parry Islands high-grade lignite or sub-bituminous coal outcrops in several places. This coal was utilized by early exploratory expeditions and could prove valuable to any future outpost or meteorological station, to which transportation would be exceedingly difficult. Other coal deposits of the Arctic islands are generally of a low grade, but being in an area where freight is expensive and fuel a necessity, they may become useful.

Small amounts of lignite coal are mined along the west side of Darnley Bay on the Western Arctic mainland, for the use of the mission buildings at Paulatuk.

Some of the western and northern Arctic islands may be possible sites for petroleum. Meagre as the information is, they are known to be composed of folded sedimentary rocks, with dome-like structures similar in age to those of the nearby oil-producing areas of the Mackenzie River Valley and the north coast of Alaska. Bituminous seepages have been reported on northern Melville Island, and further exploration might reveal others.

In the Western Arctic, native copper has been known near the mouth of Coppermine River since the days of Samuel Hearne, and has been used by both Eskimos and Indians for weapons and utensils. Reputable mining companies have investigated the ore several times and report that it is not of high enough grade for development. Copper and lead were reported from Bathurst Inlet by geologists from the southern party of the Canadian Arctic Expedition (1913-17), and have been investigated since, but they do not exist in quantities that would make their exploitation profitable.

Any prospecting or mining activity that is carried on in the Arctic faces serious problems. Exploration costs are higher than in other more accessible areas of Canada. Detailed geological mapping is scanty and structural information is generally lacking. The advantages are that bare rock is exposed in many places, and preliminary prospecting can be done from aerial photographs. Mineralization has been noted in several widely scattered places. Although deposits of present economic value have not been located, the area is vast and prospectors have covered only small sections. Whether present indications are the limits of the mineral resources, or point the way to possible development, is left for future investigations to determine.

## CHAPTER IX

### GOVERNMENT AND SOCIAL SERVICES

#### Political Geography

When Canadian Confederation came into being in 1867, all of what is now the Canadian Arctic remained directly under the control of Great Britain. This control, however, gradually passed to the Canadian Government. Full title to Rupert's Land and the Northwest Territories was transferred to Canada in 1870, but this transfer covered only those territories that had formerly been controlled by the Hudson's Bay Company, and in 1881 the islands north of this area were officially transferred to the Federal Government.

Having accepted this huge area, it was then necessary for the Government of Canada to make provision for its administration. In 1870, a small province of Manitoba was created out of the then Northwest Territories, and in 1876 an area north of this province and west of Hudson Bay was set off as the district of Keewatin. No further political division of the Northwest Territories occurred until 1882, when the remainder of the southern part of the then Northwest Territories was divided into four provisional districts. The northern part of the territories, the part including the Canadian Arctic, was not divided, apart from Keewatin, until 1895 when the districts of Ungava, Franklin, Mackenzie, and Yukon were proclaimed. It is from this date that the political divisions appeared on the map of Arctic Canada.

The establishment of the Yukon as a separate territory, in 1898, and the creation of the provinces of Saskatchewan and Alberta, in 1905, removed most of the old Northwest Territories that was not in the Arctic region from the administration of the Northwest Territories. After 1905, therefore, the Northwest Territories included all of the Arctic region with parts of the Subarctic, and was divided into the provisional districts of Mackenzie, Keewatin, Ungava, and Franklin.

Until 1912, none of the provinces included any part of the Arctic region. In that year, however, Manitoba, Ontario, and Quebec were all enlarged and extended northward to include the territory they embrace today and thus include the southern part of the Arctic region. The extension of Quebec took in all of the mainland of the former provisional district of Ungava, so that after 1912 the Northwest Territories needed to be redefined. This was done in 1918, when the three provisional districts of Mackenzie, Keewatin, and Franklin were erected as they exist today.

In 1949 the entry of Newfoundland into Confederation added a fourth province to the list of those embracing some part of the Arctic region, so that today the government of the provinces of Newfoundland, Quebec, Ontario, and Manitoba, as well as the Yukon Territory and the Northwest Territories administrations, are involved in the problems of the government of the Arctic region, although the major burden is borne by the Northwest Territories administration.

### Administration

The political evolution of the Arctic region was accompanied by increasingly effective administration by the Canadian Government.

Today the Northwest Territories are governed by a Council composed of the Commissioner of the Northwest Territories, who is Deputy Minister of the Department of Resources and Development, the Deputy-Commissioner, and five Councillors appointed by the Governor-in-Council. This body has power to make ordinances for the government of the territory under instructions from the Governor-in-Council or the Minister of Resources and Development. Such ordinances may deal with matters of

direct taxation for revenue, establishment and tenure of territorial offices, maintenance of municipal institutions, administration of justice, the issue of licences, property and civil rights, and, in general, all matters of a local or private nature within the territories. The seat of government is in Ottawa.

As the Arctic environment of the northern coast and Arctic islands forces the Eskimo inhabitants to depend almost wholly on hunting and trapping for a livelihood, one of the important functions of the Northwest Territories Council is to make and enforce the game regulations. The council also deals with such matters as hunting, trapping, and trading licences, open and closed seasons, and the setting aside of game sanctuaries and native preserves. Much of the Arctic has thus become the large Arctic Islands Game Preserve, where trapping is largely confined to Eskimos, or half-breeds of Eskimo blood.

To the Royal Canadian Mounted Police has been delegated the responsibility of enforcing law and order within the Northwest Territories. As the Eskimos are a peaceful people and white men are few in number and scattered throughout the Arctic, there is little violence with which to contend.

Mounted Police detachments have been established at suitable sites throughout the Arctic and from these centres a network of winter patrols by dog-team and summer patrols by small schooner covers most of the region and exerts direct supervision over the migratory Eskimos and the few resident white people.

Constables visit settlements and native camps, performing administrative functions pertaining to Family Allowances, Vital Statistics, relief to destitute natives, and Old Age Allowances. They also gather information concerning game conditions, issue fur export permits, and assist the natives medically, as far as is possible, with first aid kits supplied by the Department of Health and Welfare.

In 1922, the eastern Arctic patrol was initiated and since that time Government officials, police inspectors, scientists, and special investigators have visited most of the larger settlements each year. In



Plate 16. Pangnirtung, Baffin Island



Plate 17. R.C.M.P. post at Dundas Harbour, Devon Island

1933, the patrol was transferred from Government owned or chartered ships to the Hudson's Bay Company supply ship *Nascopie*. In 1947, the *Nascopie* sank after striking an uncharted reef off the coast of southwestern Baffin Island. That year the work of the patrol was only completed with great difficulty. During the following season, 1948-1949, administrative personnel, medical parties, and staff replacements were carried in various small chartered vessels and by aircraft.

In 1949, the Northwest Territories Administration organized its first air inspection trips into the Eastern Arctic. The Administrative Officers accompanying both the Eastern Arctic Patrol and the supplemental inspection flights are responsible for ensuring full understanding of administrative instructions sent to the District Registrars in the field, and for uniformity in carrying them out. Through their field experience, they are further able to advise on governmental policy.

### Education

Although under Government supervision, education in the past was left largely in the hands of the Anglican and Roman Catholic church mission organizations. As the problems of dealing with a migratory population are more difficult than those of a sedentary population such as exists in the Mackenzie River Valley, social services have not been so well developed in the Arctic. Boarding schools would reach so few children within the nearby area that the cost of education per native would be high. In addition, when Eskimo children are kept at school they are not learning the hunting, fishing, and trapping methods of their fathers, nor how to keep a home on the trail. As the Eskimo language is intricate and difficult for white men to learn, few people have attempted to translate or teach it. Missionaries used to hold day classes in which the fundamentals of reading, writing and hygiene were taught. Eskimos in the Eastern Arctic mastered a system of syllabic writing (geometric characters similar to a type of shorthand), which most can now read and write adequately. In the Western Arctic, the Eskimos learned a longhand script in Roman characters after white people entered the area.

Educational facilities in the Arctic have been expanded since World War II, with the introduction of

government day schools at several settlements in both the Eastern and Western Arctic. The increasing number of white organizations that have entered the Arctic within the past decade means that the Eskimos are no longer isolated. Because they must play a part in these changes their education is being directed towards helping them to adjust to changing social and economic conditions. They are an intelligent people, generally warm-hearted and honest, imbued with a pride of race and independence of spirit that is evident to all who have been associated with them. To ensure that they retain these characteristics in their changing world, it will be necessary for them to have the ability to converse with white persons who do not speak their tongue.

The personnel attached to the Government schools are welfare teachers, who are responsible, in addition to classroom teaching, for community organization and recreation as well as for the general wellbeing of the natives. Their primary purpose is to teach the Eskimo children to read, write, and speak English, and to acquire facility with numbers. They assist the long range health program by encouraging principles of health and sanitation. In introducing some of the facts of Natural Science, the theme of conservation of wildlife resources is foremost. In all instruction, the teacher is careful not to disturb the recognized good characteristics in the material, social, and moral codes of the Eskimo.

In 1947, the Northwest Territories Administration distributed a "Book of Wisdom for Eskimo" to some of the Eastern Arctic settlements. This booklet, written in syllabics on one page with the English translation on the opposite side, promoted education within the family and reached many Eskimos. The book explained principles of health, hygiene, game conservation, and care of equipment. It appeared again in a second edition, which contained a section in western Arctic Eskimo, printed in Roman characters, as Eskimos in this area do not understand syllabic script, and was distributed to all Arctic settlements.

### Medical Care and Family Allowances

Medical care and facilities are likewise difficult and expensive to bring to this region of vast areas,

few people, and limited transportation, but are being provided by the Department of National Health and Welfare. There are two Government-supported hospitals within the Eastern Arctic area---one at Chesterfield Inlet operated by the Roman Catholic mission, and the other at Pangnirtung administered by the Anglican mission. The Eskimos from eastern Hudson Bay have access to the new Government hospital at Moose Factory. The Western Arctic Eskimos can be brought to the mission-operated hospitals at Aklavik. All hospitals are staffed by Government doctors who spend from 1 year to 3 years in the Arctic. The difficulty of servicing such a large area with only a few hospitals has been somewhat alleviated by placing Government medical kits at all posts and by giving first aid instructions by radio from the medical centres and from Ottawa. Furthermore, nursing stations have been established at a number of centrally located settlements, and staffed by qualified nurses. Isolation huts have been provided for contagious cases.

Throughout the Arctic, Eskimos, although relying upon the resources of the land and sea for their subsistence, are dependent almost entirely upon the white fox catch to trade for essential "outside" supplies of flour, baking powder, tea, and especially ammunition. The Family Allowances program, with its controlled issues in kind under the direction of District Registrars, has helped to relieve this dependence upon a fluctuating resource. If credits are accumulated during peak years of the fox cycle they can be used later to assist the parents to buy major items of equipment, such as nets, rifles, tents, and even whale boats---the latter under co-operative arrangements. Allowances for elderly Eskimos have also been established to assist those people who may have become a burden upon their families.

Handicrafts are being encouraged as another means of supplementing the Eskimos' income. Using native materials, carving and weaving are distinctive Eskimo arts that find a ready sale.

The problems of government and administration in the Arctic are complex and difficult owing to limited resources, population, and transportation, and much of the responsibility has necessarily been given to persons within the area. For almost 70 years the Canadian Gov-

ernment has been exploring the Arctic, investigating its resources, and combatting the many problems of an inhospitable country. The fact that the area is still sparsely settled and little developed illustrates the adverse influence of a harsh, natural environment.

#### POSTSCRIPT

(To be inserted on p. 113)

Page 68, line 9, "approximately 5 months" should read "approximately 3 months".

.....

In any pioneer region such as the Arctic, conditions are constantly changing, sometimes with great rapidity. This has been the case between the writing of the manuscript of this book and its publication and the following new developments should be noted:

- Page 65 — The distributing centre for the Western Arctic is now Tuktoyaktuk, where river boats transship to Arctic vessels.
- Page 73 — Dundas Harbour detachment of the RCMP was closed in 1951 and the detachment moved to Craig Harbour, Ellesmere Island. There are now no Eskimos on Devon Island, as the only two families formerly living there accompanied the police to Craig Harbour.
- Page 107 — The Northwest Territories Council was reconstituted during 1951. The Commissioner is now assisted by a Council of eight members, one of whom is appointed by the Deputy Commissioner. Three members are elected from the District of Mackenzie and the remaining five are appointed by the Governor in Council. The first meeting of the reconstituted Council was held in Yellowknife in December 1951.

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# CANADIAN ARCTIC NORTHERN SECTION

Scale  
50 25 0 25 50 100

International Boundary

\* Settlements



50° N. 51°

110

120

130

140

150

160

170

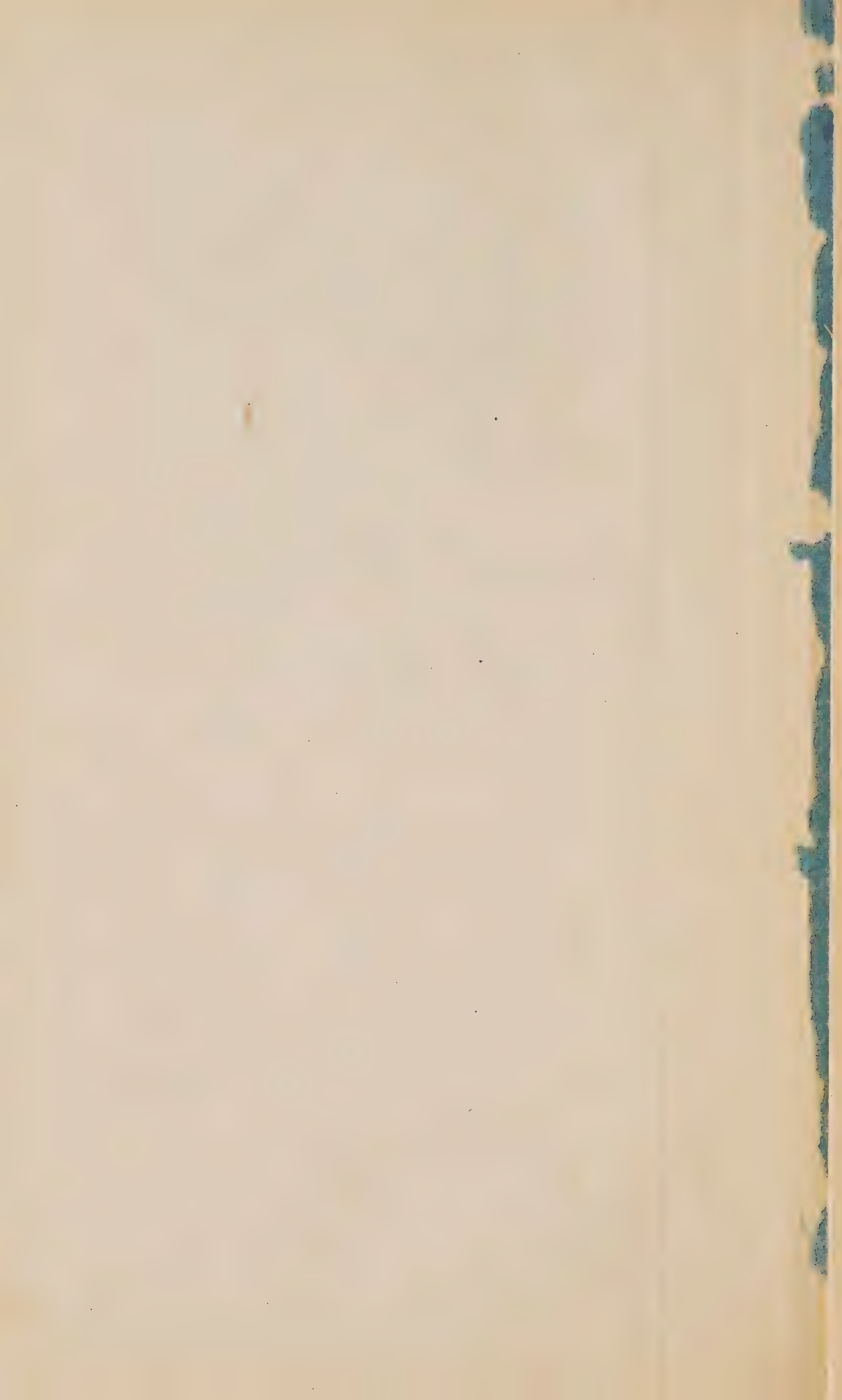
MAP A





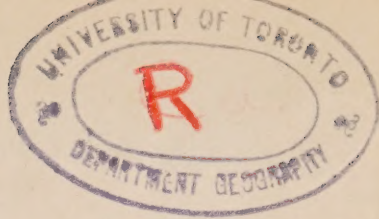












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